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# **Scientific Management Practice in Britain, A History**

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## **Abbreviations**

<b>AIC</b>	Associated Industrial Consultants
<b>ASE</b>	Amalgamated Society of Engineers
<b>AEU</b>	Amalgamated Engineering Union
<b>BPC</b>	British Productivity Council
<b>EEF</b>	Engineering Employers Federation
<b>IIA</b>	Institution of Industrial Administration
<b>ILO</b>	International Labour Organisation
<b>ITech</b>	Institute of Industrial Technicians
<b>ISWP</b>	Institute of Work Study Practitioners
<b>IFRB</b>	Industrial Fatigue Research Board

<b>IHRB</b>	<b>Industrial Health Research Board</b>
<b>NIIP</b>	<b>National Institute of Industrial Psychology</b>
<b>NUGMW</b>	<b>National Union of General and Municipal Workers</b>
<b>NUVB</b>	<b>National Union of Vehicle Builders</b>
<b>TGWU</b>	<b>Transport and General Workers Union</b>
<b>TUC</b>	<b>Trades Union Congress</b>

**Note**

The terms piecework, incentive scheme and payment by results are used interchangeably throughout



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## Summary

This study traces the influence of scientific management on the development of modern management methods in Britain from the end of the 19th century to the outbreak of the second world war. It is concerned with both the organisation of work and the management of the worker, with employers' labour strategies and worker and trade union responses. The Introduction discusses key concepts like Taylorism, Fordism and mass production; chapter one identifies technical and managerial changes taking place at the turn of the century and the reception Taylorism received in Britain; chapter 2 is mainly concerned with premium bonus schemes and the impact of the first world war; chapter 3 analyses the growth of new management functions and roles, particularly production engineering between the wars; chapter 4 discusses the impact of mechanisation and deskilling on workers in the engineering industry; chapter 5 traces the growth of piecework schemes and time study, the significance of the Bedaux system, and the impact of worker resistance. A postscript and a conclusion relate these themes to the post second world war history of work study and to contemporary debates about flexible specialisation and post-Fordism.

Three key issues are addressed; the meaning of scientific management, the extent to which employers adopted scientific management practices, its impact on workers and the effect of worker resistance.

It is argued that, if scientific management is located historically, it is seen to be concerned with the management of production as well as the management of the worker; with production engineering, progress and planning departments, as well as time and motion study and incentive payment schemes. As such it is not reducible to any *particular* form of Taylorist practice.

Employers were slow to develop the new management methods. Slow adaptation to change was part of the more general problem of relative economic decline. But both were *uneven*. British employers were reluctant to abandon tools and techniques which still made money but some did, and more followed. Taylorism was more positively received in Britain than has been suggested and was widely accepted by the end of the first world war. Its impact on managerial practice can be traced in the inter-war period in the development of production engineering and more rigorous payment systems, including those inspired by Bedaux.

A 'deskilling dynamic', centred on a new split between mental and manual labour, was fatally undermining both craftsman and foreman in the engineering industry, though it owed more to the jig and tool designer, and more broadly, the management of mechanisation, than the efficiency engineer. But changes in the labour process also affected women and semi and unskilled men and they were centrally involved in shop floor resistance to 'speed-up'. Resistance modified but could not prevent the restructuring of the labour process consequent upon scientific management.



## **Introduction**

### **Scientific Management in Britain**

This study aims to trace the influence of scientific management on the development of modern management methods in Britain from the end of the 19th century to the outbreak of the second world war. It is concerned with both the organisation of work and the management of the worker, with employers' labour strategies and worker and trade union responses. A postscript and the conclusion relate these themes to the post second world war history of work study and to contemporary debates about flexible specialisation and post-Fordism.

It is a commonplace of management literature that Taylor, along with Fayol and Weber, was one of the principal architects of modern management (Cole 1990, Pugh 1990, Woodward 1965). Drucker described scientific management as our most widely practised personnel management concept and the most powerful contribution America has made to Western thought since the Federalist Papers (1955:247) and a popular text book on organisational behaviour asserts that 'The influence of scientific management pervades management thinking and organization functioning in all industrialised countries of the world' (Huczynski and Buchanan 1991:278). That such influence has often been attacked from a human relations standpoint only serves to underline the importance of Taylor.

But historical studies have been less certain about the extent of Taylor's influence in Britain or when it occurred. On some accounts, the influence of scientific management was apparent in changes in work practices before the first world war (Stearns 1975:195; Hobsbawm 1976). For others it was a product of the first world war (Burgess 1980:166, Pollard 1983:47) while Littler (1982) and Price

(1986) identify scientific management in Britain with the Bedaux system in the 1930s. Kreis (1990) believes that Bedaux 'took Britain by storm' but also argues that Taylorism had spread from America and grew out of conditions in British workshops before the first world war. On the other hand it has been argued that while Taylorism became the accepted managerial ideology, management practice remained largely untouched by it (Child 1969:75/103; Holford 1988:60)<sup>1</sup>; that new work methods were applied with 'less zeal and more compromises' in Britain (Cronin 1984:59) and that while scientific management spread between the wars there was no 'dramatic transformation of work organisation on scientific management lines' (Gospel 1987:180). Mant believes that the 'scientific management movement began to die of natural causes in the 1930s' to be replaced by human relations strategies (1977:30) and Merkle goes so far as to argue that Taylorism in Britain never passed the 'luncheon meeting stage' (1980:230).

Such differences about the influence of Taylorism reflect, in part, uneven development and differences between industries. But they are also bound up with three critical issues. First, the meaning of Taylorism and associated concepts like classical management theory, mass production and Fordism. Second, the thesis that British economic decline is rooted in the specific character of British class relations and that the failure to rationalise production along Taylorist lines was a feature of such British backwardness. Third, that Taylorist prescriptions do not in any case account for the actual behaviour of either managers or workers, that the labour process is the product of class struggle not capitalist structures or management programmes.

Each of these issues will be considered in turn below. But the argument in brief is that scientific management was the product of a cluster of technological and



business changes at the turn of the century and is better understood more broadly as the management of mechanisation than narrowly as a time-studied system of labour control. As such its influence is apparent before the first world war and it has been more significant in Britain than has been commonly allowed. However, its development was slow, uncertain and incomplete - a process which certainly owed something to the conservative character of British capitalism but such conservatism reflected the uneven development of British and world capitalism and should be seen in relative not absolute terms. British employers did adopt Taylorism but work study spread rapidly only after the second world war. Finally, it is argued that the effect of class struggle, conducted at the point of production or at the negotiating table, modified the effects of Taylorism and exposed its weaknesses and pretensions but did not alter in any fundamental way the organisation of work and production which it inspired.

### **Taylorism, Technology and Management**

John Lee's *Dictionary of Industrial Administration* noted that scientific management could be understood in the broad sense of the organisation of industry or the narrow sense of the organisation of labour (1928:1059) and similar distinctions have been made by Gospel (Sasocki 1992:25; Gospel 1992:55,201) and Kreis (1990:32). More controversially, Taylorism has also been distinguished as the development of management from the development of technology (Braverman 1974:85); as a means of labour control from Fordism as a system of control based on machine paced work (Hounshell 1984:252); as the bureaucratisation of structures of control from the wider process of the bureaucratisation of the employment relationship (Littler 1982); and as a means of perfecting existing tasks from the separation of conception and execution, consequent upon the scientific-technical revolution (Burawoy 1978:277).

All such distinctions are vulnerable to the charge made by Palmer against Braverman that he 'arbitrarily separates vital and complex relationships that formed part of a basic unity' (1975:32). It is perfectly legitimate of course to distinguish and study separately parts of a basic unity. But it ought to be reassembled. The central argument of this thesis is that to understand Taylorism it is necessary to locate it historically in all its interconnections. Because Littler argues that Taylorism should be distinguished from the wider trends of mechanisation, job fragmentation and systematic management he concludes that scientific management in Britain is largely the history of the Bedaux company. I argue that Taylorism cannot be understood apart from those trends which formed the larger historical context. For that reason, the experience of workers, foremen and managers were often more similar than dissimilar in workplaces that adopted the Taylor system and those that did not, between firms that employed Bedaux and those that did not.

It is clear, for example, that the separation of conception from execution was implicit in the scientific-technical revolution and was developing in Britain independently of any self consciously scientific management practice. Indeed, there were those advocating such changes who were also hostile to Taylorism for its extremism. It is equally clear that Taylorism was the most important managerial tool for expressing and systematically organising such a division. It was, as the English engineering worker and writer W.F. Watson argued, 'the direct outcome of the development of machinery and was the generalisation derived from analysis of experiments in management of workshop organisations' (1935). Distinctions which might be legitimate for some purposes have been elaborated as competing concepts which become a barrier to understanding.



If Taylor were alive today, a speaker told the Institute of Industrial Technicians in 1954, he would be a production engineer (Havelock 1954). In fact, it is more likely he would have been a management consultant. He was concerned with the management of work as production management or production engineering, and the management and motivation of the worker in ways required by production management. He demanded a new division of labour among managers as well as workers. Time and motion study, arguably his single most important contribution to modern management, formed the bridge between management planning, the task defined for the worker and a payment system which would provide the incentive for first class men. He provided one of the foundation stones of a developing classical management tradition which was creating a more elaborate and specialised managerial hierarchy<sup>2</sup>. Indeed, for the British theorists and practitioners of the new management, Taylor more than anyone else was the acknowledged inspiration (Urwick 1962; Brech 1967).

Taylorism has to be located within the overall production system before it can be usefully analysed in detail (Glucksmann 1990:154; Blackburn et al 1985:4).

Scientific management grew out of systematic management, itself a product of the American system of manufacture, the process of specialisation and standardisation which laid the basis for mass production (Rowe 1928: 90). The difference between Europe and America lay not in technical knowledge but in 'how this technical knowledge and skill was used. The European manufacturer used it to make a product: the American manufacturer used it to make a process for making a product' (Litterer 1961:466). There was a double implication for technology and division of labour. First, unskilled labour could be substituted for skilled where the latter set up general purpose machinery for unskilled operators or where single

purpose machinery was installed. But secondly, the focus on organisation and the study of work generated pressure to improve processes and update and standardise machinery, accelerating the search for technological innovation in further developing standardisation and division of labour. At the very least, as A. P. Young, managing director of British Houston Thompson remarked in the 1930s, 'this new outlook on human economy must have a profound effect on tool and fixture design' (1937:152).

The relationship between Taylorism, technology and management is therefore central. Landes' summary remains unsurpassed:

.... reorganisation of work entailed reorganisation of labour: the relationships of men to one another and to their employers were implicit in the mode of production; technology and social pattern reinforced one another ....the effort to improve the worker's efficiency, an effort which grew out of the increased efficiency of capital, opened the way to advances in the use of equipment. Scientific management was logically linked both as cause and effect to the innovations in machine tool operation, handling of materials, division of labour in the shop, and organisation of work flows discussed above, for the establishment of norms rested on an analysis of the production process and inevitably turned up both weaknesses and possibilities of improvement. What Taylor preached was the substitution of reason for habit, a new way of looking at familiar things (1969:317,321).

Taylorism in the sense described above could, and did, exist independently of time study, much as Taylor himself would have disapproved. Hobsbawm notes that outside the USA before 1914 scientific management hardly existed in the modern sense of its association with time and motion study. 'However, in a more empirical way even this was implicit in mass production by specialised machines or processes which now expanded greatly; particularly where labour was the expensive factor. Innocent of Taylorism, the Bristol Boot and Shoe employers, who devised the team system around 1890, applied his principles. They sub-divided the process and made sure that the team was 'waited upon hand and foot and never kept waiting for anything, whereas when they have to "shop" their own work a waste of time is involved' (1976:359). As early as 1906 the industry adopted the machinery and patterns of subdivided labour common in the USA and piecework was spreading rapidly before 1914, but work study did not reach the boot and shoe industry until after the second world war (Fox 1958:264; *TSE* July 1950).

In his study of scientific management in Australia, Chris Wright argues that the dominance of Taylorism only became an article of faith within academic literature because a broad definition was adopted (1993:34). If a narrower definition focusing on the control of the worker is used, a process which Wright, following Littler, calls the bureaucratisation of the shop floor, scientific management is shown to have much more limited impact. And on Wright's definition an account of scientific management in Britain would be remarkably similar to that in Australia. The Australian Institute of Management was formed after the first world war and consultants were active in the 1930s. But, as in Britain, it was the 1950s and 60s which 'were the boom years for the application of Taylorist techniques' (1993:40) with work study departments being absorbed within general production management in the 1970s (1993:47).



The problem with the narrow approach taken by Wright is that ultimately it makes scientific management incomprehensible as a complete historical phenomenon. It would be impossible to understand why Taylor demanded a mental revolution on the part of employers and why they found his demands sometimes impossible to accept; how it could have inspired an international management movement; or what possible claim it could have to pervade management thinking in all industrialised countries. Work study was Taylor's single most important contribution but he also laid the foundations of production engineering (Armstrong 1961:278)<sup>3</sup>. When work study practitioners created their own professional organisations in the 1940s, they established three of them. The Industrial Technicians specialised in time study and the Motion Study Society, in motion study. The body which became the Society of Industrial Engineers were specialists in production planning and control and believed that 'the scope of work study practitioners should cover all activities involved in the planning and control of industrial production, and should not be limited to method study, motion study, and work measurement' (*TMS* Feb. 1955). Taylorism was a distinctive link in the chain of development of management methods but it was also an integral part of the process of economic change in which changes in business organisation, technology and labour management were interdependent and mutually reinforcing.

### **Taylorism, Fordism and Mass Production**

We have argued that Taylor was both the product and prophet of a set of economic, technical and business organisation changes at the turn of the century. A more ambitious attempt to relate scientific management, mechanisation and division of labour is advanced by the French regulation school which has argued that regimes of accumulation and associated modes of regulation characterise the

development of capitalism. According to Lipietz, 'Very schematically, the regime of accumulation which prevailed in the most advanced capitalist countries between the first industrial revolution and the First World War was primarily extensive, and centred upon the extended reproduction of means of production. Since the Second World War, in contrast, the dominant regime has been intensive and centred upon the growth of mass consumption' (Lipietz 1987:33). From our point of view the most interesting point is the argument that Taylorism, as a revolutionary new mode of work organisation, was the critical moment in the transition between one regime of accumulation and another (Lipietz 1987:35,36; Aglietta 1987:116,118; Brenner and Glick 1991:57). Fordism supersedes Taylorism as a new stage in the regulation of capitalism: a new regime of intensive accumulation marked by a labour process based on semi-automatic assembly-line production and institutional regulation founded on an extension of working class purchasing power backed by the development of collective bargaining and state spending.

The immediate problem with regulation theory is periodisation. Taylorism arises in late 19th century America; Fordism is a real phenomenon for contemporaries by the first world war. But Fordism as a regime of accumulation with matching institutional regulation only succeeds after the second world war. It is as if the transition to the new regime stretched from the late 19th century to the second half of the 20th century, but the new regime itself only lasts twenty years, beginning to break up in the 1960s. Lipietz observes that the crisis of the 30s can be analysed as the first crisis of the period of intensive accumulation or the last for the period of competitive regulation (Lipietz 1987:34). It would seem preferable to regard both the crisis of the 1930s and the post war boom simply as phases in the development of 20th century capitalism rather than as landmarks for regimes of accumulation.



A second problem is the precise relationship between regimes of accumulation and modes of regulation. Other than in times of crisis one might reasonably expect mass production and mass consumption to go together but the theory claims more than a simple correspondence. It is argued that social institutions were created to guarantee consumption. For example, Aglietta believes Fordism implied legislative arrangements such as the establishment of social insurance, and that Fordism would be incomprehensible without centralised collective bargaining (1987:159,195). But quite different social insurance and collective bargaining arrangements are to be found in countries with the same Fordist production regime and it is unclear why either should be a *necessary* consequence of the regime of accumulation .

At the same time the criticism of the regulationist position can be pushed too far. In their wide ranging critique Brenner and Glick argue reasonably enough that craft worker control cannot adequately characterise the labour process of the regime of extensive accumulation but go on to suggest that the Taylorist-Fordist process only 'represented a further phase of an ongoing, though hardly continuous, evolution' (1991:59). It was not a critical moment of discontinuity but simply an extension 'of the processes of transforming technology and the labour process that have characterised capitalist production for at least a century' (1991:99). This runs the risk of reducing history to empty generalities. There is ample evidence to support the view that the *combination* of changes in technology, management and business organisation at the turn of the century did amount to a moment of discontinuity; this argument is pursued in detail in chapter 1.

Other uses of terms like Fordism and mass production have little theoretical substance. A distinction commonly made is that between Taylorism and Fordism, with the latter as a labour management strategy based on machine pacing. Littler



argues that Fordism is 'systemic' while Taylorism is not because the latter might be applied to one department only, leaving the rest of the factory untouched, whereas notions of flow production and automation were 'intrinsically systemic' (Littler 1982:187/188). But in fact assembly lines or any other form of machine pacing, might operate in one part of the plant only. Even in the motor industry no more than 18% of the workforce were assembly-line workers (Chinoy 1964). And the extension of mechanisation and division of labour which underpinned Fordism operated in industries without assembly lines. If something called Fordism is systemic, it is only so because it expresses in extreme form a critical part of a common experience.

Exactly the same is true of Taylorism. It will be important for some purposes to distinguish rationalisation in, say, the boot and shoe industry from what scientific managers were doing, but not for others. As Bardou et al argue, 'The trend towards tighter management control eventually found a name (scientific management), a prophet (FW Taylor), and some basic principles: openly scientific procedures to determine the most mechanically efficient way to perform tasks, insist that employees follow these methods even if they contradict traditional usages, and reward workers liberally. Although scientific management was often called 'Taylorism', it was more than a one man crusade and would probably have evolved without the pressure of Taylor at all' (Bardou 1982:67).

Flink says that the term mass production originated with Henry Ford's use of the term in an Encyclopaedia Britannica article in 1926, 'Until then, the system of flow production techniques perfected at the Ford Highland Park plant was popularly referred to as "Fordism"' (1988:47). In fact the term was used earlier and more widely. Morris's production manager, F.G. Woollard, was criticising its use in

1924. He preferred the phrase continuous production because modern flow production did not necessarily mean producing enormous quantities (1924:420). Austin preferred the term progressive production but it amounted to the same thing.

Such contemporary uses have not satisfied historians. Tolliday describes the British approach as 'intermittently enlarging quantity flow production' (1987:301). Overy distinguishes between flow production which involves a moving assembly line and mass production which may involve flow production but does not necessarily do so (1976:83). Wild makes a similar distinction but says that flow production may be based on either a manual process or an assembly line (1973:6). There is a danger that such distinctions multiply without meaning. Woollard identified the key elements in his *Principles of Mass and Flow Production* '... flow production is the modern form of mass production, born of a marriage of management and mechanism in which management is the dominant partner' (1954:187). We will argue that the marriage of management and mechanisation is also the key to understanding Taylorism.

More recently, Williams et al have argued that Ford's production strategy was not Fordist at all (1992). Their argument is that the key to Ford's success did not lie in the division of labour or the conveyor belt but in a policy of continuous improvement in layout and work flow, a policy the Japanese now call *Kaizen*. Nor does the Fordist stereotype fit in other respects. Ford's operations were flexible; most of the machinery at Highland Park was general purpose machinery used with specially designed jigs and there was no Taylorism or time study at Highland Park where foremen set the work pace. Far from being standardised, the Model T was a stretchable product with countless changes in its design over the years. The move



to River Rouge ended the experiment. Rouge was a long travel factory and its twenty seven miles of conveyors generated new problems of rigidity and inflexibility.

But if Ford invented a low stock, lean production operation it was a result of policy failure not success, since Highland Park was planned to run with twenty five days stock cover and it only worked because of insatiable demand. Stretchable or not, the Model T initially offered huge advantages over multiple models (Sward 1968). Changing over to what Hounshell characterised as flexible mass production cost Ford \$18 million and involved scrapping around a quarter of the existing machines, rebuilding half of them and purchasing 4,500 new ones (1984:288). Ford was certainly committed to constant experiment, continuous revolutionising of methods. But contrary to Williams et al there does seem to have been time study at Highland Park. Sward cites Arnold and Faurote on how 'one human automaton at Ford's had been taught to raise his daily quota of 7000 pieces of work, thanks to a time and motion study which showed that he had been making 70,000 waste motions per day' (1968:47). And Meyer cites Ford on stop watch studies to increase the division of labour and increase output. In the space of a few years Ford transformed his factory from 'a congeries of craftsmen shops' to a fragmented, machine paced operation carried out by semi and unskilled operatives (1981:21,15,50).

Williams et al dismiss concepts like mass production and Fordism (and their opposites, flexible specialisation and post-Fordism) as representing the post-Marxist continuation of a 'marxisant' tradition of interpreting the genesis and resolution of economic and political crisis in the advanced capitalist countries. In fact terms like mass production and Fordism were not designed by Marxists - or at

least they cannot claim exclusive ownership - nor did they originate in the current debate about flexible specialisation. Nor does it seem in the least reasonable to locate Daniel Nelson (who dismisses Braverman in a footnote) or Alfred Chandler, both of whom discuss mass production, in a marxisant tradition.

But it *is* reasonable to ask whether such concepts are useful or not. Hyman has questioned whether they are empirical generalisations or ideal types. If the former, they are open to criticism on empirical grounds. If they are ideal-types and involve 'a level of abstraction not directly susceptible to empirical testing, then it is necessary to explain precisely how the notion informs historical and contemporary explanation (a familiar problem with ideal type analysis)' (1991: 275).

If Taylorism is tied too narrowly to Taylor's own particular prescriptions including functional foremen and a payment system based on a differential rate, and Fordism is tied too closely to what Henry Ford did in the Ford plants and to the assembly line as the basis of the labour process, then the answer is that they are probably more of a hindrance than a help. Tolliday and Zeitlin, having defined Fordism (reasonably enough) as the 'manufacture of standardised products in huge volumes using special purpose machinery and unskilled labour' argue that it was unsuitable to British and European market conditions<sup>4</sup>. In Britain, Fordist production strategies coexisted uneasily with 'Sloanist marketing strategies' (Tolliday and Zeitlin 1986:7). But at General Motors, Sloan too could be said to combine Fordist production strategies and Sloanist marketing. In fact Ford himself was forced in the same direction. The whole product and production strategy of the Model T, which had been such a brilliant success, was in ruins by the mid 20s. David Noble even left Ford out of his account of how engineers designed America on the grounds that he 'resists categorisation' (1977:283).



On the other hand, Taylorism, mass production and Fordism are important precisely because they express something of the essence of the most advanced forms of capitalist production and this is the sense in which they are used in this study. Ford serves as a symbol of the era because his enterprise was an early, dramatic and extreme manifestation of key characteristics of the period, not because he was typical. They are abstractions in the literal sense that they disregard the complexities of concrete history in order to identify what is essential in the new developments. As such they can be useful analytical tools. Their empirical verification consists in the extent to which they succeed in illuminating experience. They have to be consistent with the evidence. Where such concepts take on a life of their own, either as theories without empirical support, or models narrowly based on a particular experience of a more general phenomenon, they can obscure what they set out to explain.

The relevance of this argument to Taylorism in Britain is simply this. Too many judgements about scientific management have been made by considering too narrowly the question of management practice according to a set of Taylorist nostrums. If scientific management was in part the *product* of wider economic and technical change, elements of scientific management will be apparent in a more mixed managerial practice wherever more elaborate managerial structures were put in place to plan production more systematically, and in particular, to exercise more detailed direction over the work that employees did and the ways in which they did it. We would miss a great deal about management change in Britain if we confined the search to firms which practised precisely what Taylor preached. At the same time, if we see Taylorism as a force *shaping* those wider economic and technical changes we will not be satisfied with explanations of the fate of scientific

management in Britain which depend on more limited markets and varied production.

### **British Economic Decline and Class Relations**

Although Payne is unconvinced by the entrepreneurial failure thesis as an explanation of British economic decline he does identify some failures, one of which was 'the continued indifference to - even outright hostility towards - Taylorism and scientific management' (1978:218). The failure to root out craft practices and the unwillingness of employers to sacrifice social and industrial peace for the promise of scientific management have been attributed to the social nature of British capitalism, its early industrial institutions and a non interventionist state unable to challenge an unenterprising culture (Fox 1985:225,343; Edwards et al 1992:4-5). Elbaum and Lazonick (1986) believe that British decline followed from institutional rigidities formed in the 19th century. It has been argued that Britain failed to develop a service class capable of sustaining scientific management (Urry 1986); that employers preferred human relations strategies (Merkle 1980); that shop floor control was surrendered to shop stewards and could not be regained (Lewchuk 1987); and that the aristocratic ruling class culture of British capitalism was hostile to production values (Wiener 1981; Glover 1978; Glover and Kelly 1987).

A case can certainly be made that the conservatism and pragmatism of British capitalism runs like a thread through the 20th century, inhibiting and limiting industrial change. Modern forms of management only emerged slowly and unevenly. The Anglo American Productivity Council was hardly less critical of British performance in the 1950s than the Moseley Commission had been in 1902. Production management was a continuing area of weakness (PEP 1965:17; Wild



and Gallagher 1977; Gospel 1992: 49) and this may still have been true in the 1980s<sup>5</sup>. This is nevertheless only one side of the story. Employer hostility to scientific management has been greatly overdone, scientific management practices were adopted more widely than has been suggested and the use of work study grew fastest after the second world war just as the rate of British relative economic decline accelerated. All these issues are addressed in the body of the study. We comment below on two of the more important themes, the notion of institutional rigidities and worker control on the shop floor.

Elbaum, Lazonick and others have argued that rigidities in the social and economic institutions that developed in the 19th century were at the root of decline. These included specialised product markets, destructive competition among small scale family firms, and the consolidation of job controls by many groups of British workers, 'aided by the growing strength of the Labour party and the emergency conditions of two world wars' (Elbaum and Lazonick 1986:6). In cotton the failure to integrate spinning, weaving and marketing, fierce competition, rigid wage lists and the conservatism of vested interests ensured continued technical backwardness (Lazonick 1983). Unlike America, the transition from iron to steel in the United Kingdom took place without disturbing the structure of small scale producers and competitive firms and trade union organisation and collective bargaining arrangements survived intact (Elbaum and Wilkinson 1979).

The institutional perspective has a certain attraction. British economic performance in the 20th century is almost certainly rooted in the difficulties of adapting social and economic structures of one period to those of another. And there is plenty of evidence to suggest that a British conservatism rendered many of the key institutions inflexible (Levine 1967; Aldcroft 1981; Aldcroft and Richardson 1969;

Chandler 1976). On the other hand, there is no consensus that British economic difficulties stem from the late 19th century as opposed to the early 20th century or the period after the second world war. Nor is there agreement on the underlying thesis of Elbaum et al, that it was entrepreneurial failure that explains the rigidity of inherited institutions (Payne 1988; Pollard 1989; McLoskey 1970; Dintenfass 1992).

The perspective suffers from trying to do too much. The concept of 'institutional rigidities' itself becomes an inflexible tool of analysis in trying to understand the *uneven development* of the British and world economy<sup>6</sup>. There is no one, catch all explanation for such a complex process.

The family firm may have retarded the development of corporate structures in Britain as compared with America but family firm conservatism was common in Europe (Harbison and Myers 1959), and 'research on other European countries suggests that Britain was no slower than France, Germany or Italy in the early introduction of multidivisional organisations' (Hannah 1976:185). Tolliday provides a convincing account of the consequences of fragmented and competitive markets in steel and the failure of employers with vested interests to rationalise the industry. But he is not convinced that rationalisation was necessarily 'an ideal solution or a high road to economic success'. And in any case, 'even by muddling along, the industry equalled or bettered the performance of its European rivals and survived to serve the war economy and prosper in the post war boom' (1986:105).

The weakest part of the case is the assertion that job controls established by British trade unionists at the end of the 19th century were consolidated through the 20th century and served as an obstacle to modernisation. This seems to be more of a



requirement of the theory of 'institutional rigidity' than of the evidence. Even if it were true that craft workers were more firmly rooted in British industry than elsewhere at the end of the 19th century, the balance of forces in the class struggle cannot be frozen in this way and projected across the 20th century. We have to take account of defeats as well as victories and the overall direction of change. The ability of engineering workers to fight off changes to the division of labour in the period before the first world war has been exaggerated. Bedaux engineers were more common in the cotton industry from the mid 1930s than anywhere else. And a steel employer told an enquiry into trade unions in 1935 that 'the Iron and Steel Trades Confederation is the best, the most intelligent, and the most ideal trade union in the country' (Hilton 1935:207). New management structures, payment systems and a new division of labour on the shop floor and in the office all found their way through despite institutional rigidities.

Explanations of British economic decline which rely more directly on the supposed power of shop floor workers also locate the problem in the late 19th century. Lewchuk, for example, argues that the failure to carry through the change to measured day work in the 1960s was 'the last chapter in a sequence of events which can be traced back to British management's inability to break labour's influence over the organisation of the workplace in the final decades of the nineteenth century' (1987:215). His argument is that British producers adopted American production techniques but not the production institutions that went with them. Piecework allowed labour to control the pace of work. The transfer of authority from workers to managers achieved by Ford was incomplete in the British motor industry where managers were 'unable to alter the production institutions which continued to be based on the institutions employed during most

of the nineteenth century when the production process revolved around the skilled artisan' (1987:5).

Tolliday (1987) has delivered the obvious rejoinder to the claim that worker resistance frustrated management change by pointing to the weakness of the unions in the motor industry. We argue in chapter 3 that Austin and Morris at least, operated sophisticated management control systems between the wars and, in chapter 5, show that piecework systems were increasingly underpinned by time study and conceded very little to the shop floor. Interestingly enough Lewchuk himself notes examples of trade union advocacy of American methods (p104) and suggests at one point that limitations to managerial authority were self imposed (p160). Insufficient attention has been paid to both of these points. The institutions of the labour movement, trade unions, TUC and Labour Party, quickly identified themselves with the progressives and modernisers in the scientific management camp. This did not prevent shop floor resistance but it did limit its scope and deprive it of important sources of organisation and support.

There is truth too, in the idea that limitations to managerial authority were 'self imposed'. The conservatism and short sighted pragmatism of British capitalists and managers cannot be explained away as determined by the force of circumstances or by the action of others.

### **The Labour Process**

The theoretical framework that informs this study derives from Marx's view of the capitalist labour process as one determined by the demands of value production. The source of surplus value is unpaid labour, and the source of relative surplus value is an increase in the productivity of labour achieved by the use of improved



machinery or methods of working. Since there is an inbuilt advantage to the capitalist in increasing the intensity and effectiveness of labour, in closing up the gaps in the working day, and lowering the cost of labour power, the management of the worker in the labour process is a matter of vital interest. In the process of the production of value, all kinds of labour-power are reduced to the simple, abstract labour embodied in commodities. From the point of view of the value of commodities, Marx described this as part of a 'social process that goes on behind the backs of the producers' (Marx 1977:51). From the point of view of the management of the labour process, the division of labour based on particular kinds of labour-power is continually broken down and reconstituted in ways which also tend to reduce all labour to simple average labour. Mechanisation extends the productive power of the worker but also enables the capitalist to seize control of production from the producer and reduce the worker to a mere appendage of the machine. Braverman's analysis of Taylorism as the 'explicit verbalization of the capitalist system'<sup>7</sup> extended and enriched this analysis for the 20th century.

The acclaim which greeted Braverman's *Labor and Monopoly Capital* was soon buried in an avalanche of criticism. It was argued that he had offered a one dimensional view of control relations that ignored other sources of capitalist authority and the use of alternative strategies (Littler and Salaman 1982); neglected worker resistance (Friedman 1977) making the capitalist class appear all powerful and the working class inert (Elger 1979); failed to appreciate the contradictions which beset *any* management strategy (Hyman 1987) and failed in particular to understand how the labour process was shaped by the need to secure worker co-operation and consent (Cressey and MacInnes 1980; Burawoy 1979). Braverman's postulate of a 'linear process of deskilling and intensifying control' (Littler 1990) was challenged on empirical as well as theoretical grounds. At a



more fundamental level, exception was taken to Braverman's insistence on analysing the working class as a 'class in itself' (Stark 1980), which in turn reflected more far reaching debates about the base-superstructure metaphor in Marxism and the whole relationship of structure and agency, reaching far beyond Marxism and the labour process to 'the central dilemma of the social sciences' (Edwards 1986:60).

One purpose of this study is to test some of these arguments historically. It was Marx who argued that events must be studied in their historical context and not with the aid of 'the universal passport of a general historico-philosophical theory, the supreme virtue of which consists in being super-historical' (1934:352). The development of the labour process in Britain cannot be 'deduced' from labour process theory. It must be investigated as a unique historical experience. Labour process theory identifies immanent tendencies within capitalism. It does not, and could not, begin to describe the particular outcomes in a given, concrete capitalist formation where the level and development of production technique, history, culture and class struggle all play a part in shaping society<sup>8</sup>.

We can illustrate this point with reference to the controversy about deskilling. Marx argued that 'Intelligence in production expands in one direction, because it vanishes in many others'; that the simple separation of a hierarchy of labourers is replaced, first by the distinction between skilled and unskilled and always by the pressure to cheapen labour power, except where 'the decomposition of the labour-process begets new and comprehensive functions' (1977:341, 331). Similarly, Braverman thought that the reconstitution of the labour process under management control was an ideal 'realized by capital only within definite limits and unevenly among industries' and one which itself created new crafts and technical

specialities (1974:172). There is therefore no inevitable, inescapable elimination of all skills at all places and at all times. What there is, as Armstrong clearly explains, is a 'deskilling dynamic - or 'law of motion' - intimately linked with the operation of the capitalist economy' (1988:144).

An historical exploration ought also be able to move beyond the terms of the exchange between Braverman and his critics. Storey was probably right to say that the 'labour process bandwagon has run into the sand' (1985:194). Thompson's rejoinder defending labour process theory only tends to confirm Storey's judgement since his version of the 'core theory' jettisons so much of its former theoretical baggage that little of substance remains (1990).

One reason for this state of affairs may be that so much of the criticism which Braverman attracted simply fails to connect with its target. Braverman is not concerned with the whole capital-labour relation but the way in which *the human activity of work* is transformed and degraded through capitalist relations of production, and the consequences for the structure of the working class and patterns of occupational change. His discussion of industrial psychology and sociology shows he is clearly aware of other managerial techniques brought to bear on the worker<sup>9</sup> but he sets them aside because 'they do not by and large concern themselves with the organisation of work' (1974:140). His 'neglect' of other aspects of the employment relationship, of other sources of capitalist authority and control and of the activity of workers and trade unions clearly means that he does not seek to provide a complete picture of class relations even in production, much less at the level of society or the state<sup>10</sup>. Management, for example, may be based on Taylorism but management practice is not reducible to it.



These are important limitations. It certainly means that Braverman does not provide a complete account of the social organisation of production as it actually develops in the workplace; of the effects, for example, of continuing divisions among workers based on the survival of 'craft' job monopolies or, more generally, of the influence of competition among employers and between groups of workers (Elbaum et al 1979). However, the first question is whether subsequent studies with a different focus on the labour process have undermined what Braverman *did* say. A second, and more fundamental question is posed by Elger, who argues that Braverman is not simply *incomplete*, but that his analysis *closes down* crucial questions about the relationship between the capitalist labour process and class struggle and broader forms of political domination and struggle (1979:60-61).

This study, by contrast, argues that the insights of Braverman's analysis remain fundamental to understanding the labour process and that the failure to integrate such insights into analyses of the wider social organisation of production can lead to contradictory and even absurd results. Thompson (Snr), for example, argues that the work of Coventry car workers has been deskilled although, 'Paradoxically, Coventry engineers took a pride in the very specialisation which was in a more general sense a sign of their own deskilling' (1988:58). This leads to some interesting discussion of shop floor culture but also to the odd conclusion that 'Coventry skilled men of the 1970s had already survived by a full half century the dire collapse of the labour aristocracy portrayed by Hobsbawm' (1988:67). But whatever it was that had survived into the 1970s, it wasn't Hobsbawm's labour aristocracy! At the centre of this issue is the nature and effects of worker resistance and it is to this question that we now turn.

## **Worker Resistance and Employer Strategies**

The key question might be put this way, how far were the laws of motion of capitalist economy bent, shaped or overturned altogether by the struggles of workers and their employers. If, 'In the social production of their existence, men inevitably enter into definite relations, which are independent of their will' (Marx 1970:20), to what extent did they subsequently succeed in exercising a will of their own? And if, as Braverman says, workers were forced to 'build for themselves more 'modern', more 'scientific', more dehumanized prisons of labor' (1974:233) why has there not been a revolt? These questions do not stop with Braverman of course. According to Thompson, Marx too, 'failed to reconcile adequately his analysis of the transformation of work and the form and content of workers' struggles' (1983:58). Price puts the same question but in a larger frame when he notes that history has not produced the revolution required by the Marxist analysis of capitalism (1986).

In the labour process literature, this question is usually discussed in terms of worker resistance and the employer's need for worker co-operation, but too much is claimed for both. For Cressey and MacInnes, the need for co-operation arises from the two fold character of labour power, as exchange value and as use value. To obtain the useful aspect of labour power capital must surrender control of the means of production to the worker for use in production while workers in turn have an interest in maintaining the viability of the unit of capital which employs them (1980:14-15). Friedman's argument that worker resistance can force employers to adopt alternative labour management strategies, responsible autonomy rather than direct control (scientific management), has been equally influential.



But the compulsion to co-operate does not arise in the way Cressey and MacInnes suppose, nor is it specific to the capitalist labour process. Slave owners surrendered the means of production to slaves too, and unless a degree of co-operation had been secured, stock would be hobbled and crops wasted. Slaves also slowed the work down, attempted to establish work norms, falsified the weight of cotton and made gains in the quality of everyday living as a result (Genovese 1976:621). Co-operation with capital is, in the first instance, an expression of the worker's dependence. The establishment of a *modus vivendi* may become a way of life, may even be preached as a virtue. As such it has enormous importance in every day life and, in the shape of reformist trade unions and political parties, a corresponding importance in social life. But such phenomena are not derived from the *essence* of the capitalist labour process. They are a product of the struggle created by that process.

Friedman's distinction between responsible autonomy and direct control strategies overlooks the way elements of both can be combined. The gang system at Standard's car plants in Coventry ceded, for a time, key controls to shop floor workers and their representatives (Donnelly and Thoms 1989). But the introduction of the gang system was preceded by a major time study exercise in which hundreds of jobs were re-classified, and 'craft union interests in particular job functions had to be overridden in the interests of securing the division of labour and allocation of work appropriate to the operation of a modern motor vehicle and tractor plant' (Melman 1958:36).

There is, nevertheless, a point of real substance in the criticism that the effect of human agency cannot be left to one side. The labour process has manufactured consent as well as conflict and this is as important for what people do and the way



they live, as the process of value production. At the very least, it is clear that the *actual* social organisation of production cannot be simply 'read-off' from trends in the labour process. Braverman believed that worker hostility had been forced into subterranean streams from which revolution would be the ultimate escape (1977). But that hostility also expressed itself in the struggle for more limited, immediate gains. Workers might not have demolished Braverman's prisons of labour but they made them more habitable.

Such resistance is, as Friedman observes, double-edged, since it allows 'the possibility for capitalism to accommodate such challenges by offering concessions and by co-opting institutions which were intended to marshal worker solidarity against aspects of managerial authority' (1977:54). We will discuss the effects of worker resistance in struggles around premium bonus (chapter 2), the machine question in engineering (chapter 3) and against the Bedaux system in the 1930s (chapter 5). In each case, concessions to worker resistance were matched by accommodation to the demands of capital<sup>11</sup>. What has not been sufficiently appreciated is the extent to which the institutions of the labour movement and its leading figures were positively *supportive* of scientific management. The speed and thoroughness with which trade unions adapted to the demands of Taylorism is particularly striking.

Turning to employer strategies, two points might be made. First, management is not reducible to Taylorism. When Taylor died in 1915, time and motion study was still in a primitive state, even as practised by Taylor, and a whole raft of other management techniques for the design of work and the management of the worker had yet to be developed. But Braverman was clearly right to argue that Taylorism had not been superseded. Urwick thought Mary Parker Follet and the Hawthorne

experiments had supplied a 'missing segment in our theoretical knowledge of management' (1956:48-49). His four-sided pyramid of management knowledge found no difficulty in incorporating Taylor and Myers on one side dealing with the task and the man, and Fayol and Mayo on the other dealing with the group and its morale (1956:53). Scientific management and human relations have sometimes been presented as competing philosophies corresponding to strategies of control and seduction but 'Seduction now complements control in virtually every major corporation' (Hurd: 1987:239). The compatibility of apparently different strategies was clearly revealed in the enthusiasm of the work study industry for job redesign in the 1970s.

Secondly, scientific management did not make management all powerful. And not just because workers resisted. It formed part of a significant advance in terms of the organisation of production and provided new techniques for increasing the intensity (and productivity) of labour. But there was precious little scientific about Taylor's time and motion study. His belief that he could take the determination of a fair day's work out of the realms of argument between worker and employer proved to be a utopian illusion<sup>12</sup>.

Finally, this study seeks to extend the scope of the labour process debate in two directions. First, the reconstitution of the labour process on the shop floor required the reconstitution of management itself. This involved more than the demotion of the foreman and the appearance of the rate fixer. It also involved the development of new functions in planning and directing production. Daniel Nelson (1974, 1980, 1992) has addressed the impact of scientific management on management in detail but this tends to get left out of a labour process debate centred on the skilled worker. And this leads to a second point. The impact of Taylorism on unskilled



and semi-skilled workers has been woefully neglected. In part this is understandable because the craftsman was the principal victim of the separation of conception from execution. But it is clear that Taylorism's field of operation included labour of all kinds.

### **A Note on Sources**

Extensive use has been made of the technical journals, particularly in engineering. They are the best, single source for changes in management and technology, and much else besides. In his *Scientific Management in Europe*, Devinat notes that 'it is the technical periodicals that offer the most valuable documentation' (p92), and Landes too, says that the best source for scientific management 'remains the contemporary engineering periodicals' (p322, footnote). The technical journals provide a unique record of the discussions of engineers and managers about their tasks. Reactions to scientific management range from the enthusiastic endorsement of *Cassiers* through the early scepticism of *Engineering* to the outright hostility of *The Engineer*.

*Cassiers Magazine* was founded in 1891 and originally published in New York and London. American influence was pronounced with articles regularly reprinted from the New York magazine, '*Industrial Management*'. In December 1913 it became *Cassiers Engineering Monthly* (incorporating *Cassiers Magazine*), and in 1919, *Engineering and Industrial Management*, a magazine 'devoted to management, production and economy in engineering, shipbuilding and all other branches of industry'. In 1921 the magazine incorporated *Works Management* and in 1923 changed its name again, to *Cassiers Industrial Management*. In the mid to late twenties, it

became more and more preoccupied with changes in mechanical handling technology and continued publication from 1929 as *Cassiers Industrial Management and Mechanical Handling*. *Cassiers* was a supporter of 'modern' and scientific management methods. On the occasion of incorporating *Works Management* its editorial declared that both journals had covered much the same ground: 'The application and practice of scientific management in our factories and works has been the predominant feature of the policy adopted by *Engineering and Industrial Management*, since its inception thirty one years ago'.

Interestingly enough the two heavyweights of the British engineering press, *The Engineer* and *Engineering*, were both founded by an American, Zerah Colbert (Armytage 1961:184). The older of the two, *The Engineer*, was the more conservative. The editors resisted calls for standardisation and, though strong supporters of premium bonus, were dismissive of time study. Of particular interest is the journal's sustained hostility to Taylorism expressed in a series of scathing editorials, angry exchanges with Gilbreth (1917), and most *unengineering*-like tirades against the 'tyranny of human efficiency' (1921). In similar vein *The Engineer* defended 'English methods' from critics inspired by American practice.

*Engineering*, founded in 1866, was similar in design to its sister journal. Overwhelmingly technical and immensely detailed both journals provided wide ranging comment on labour issues and management developments. In 1911 the magazine became involved in controversy with Gilbreth over motion study and scientific management and this has been widely quoted as evidence of British employer hostility to scientific management and the



strength of union opposition to it. But this is misleading. *Engineering* showed an early appreciation of Taylor's work, demanded a sharp distinction between manual work and thinking and managing (1903), and called for Taylor's time study to be used with premium bonus schemes (1905). Reservations about scientific management 'extremism' were quickly dropped during the first world war.

The leading journals had a significant readership among employers and an international reputation. The Moseley Commission seems to have had its origins in responses to a series of articles in *Cassiers Magazine* on the theme of American competition. Tom Westgarth, managing director of Richardson's, Westgarth and Co., Middlesbrough, wrote to complain about British workers and suggested a visit of 'masters and workmen' to include trade unionists and non-unionists to America. *Cassiers* responded by conferring with employers in 'London, Manchester, Leeds and other places' and establishing a fund for the visit, the outcome of which was reported in detail in subsequent issues. For its part, *Engineering* was described by an American correspondent as the Times of the engineering profession when he wrote to rebuke the 'Thunderer' for its criticism of scientific management. When the editor, W. H. Maw, died in 1924, *Mechanical Engineering*, the journal of the American Society of Mechanical Engineers wrote that '... his editorial office was a Mecca for distinguished American engineers who called to introduce themselves and to thank him for what he had done for the profession'.

Notwithstanding sharp differences in editorial line all the main journals carried reports on American competition, engineering conferences, debates on premium

bonus, technical change and implications for shop management, making it possible to trace the growing acceptance of scientific management in the midst of *The Engineer's* criticism and the continuing gaps in British practice in the pages of *Engineering* and *Cassiers*. Of the other engineering journals cited, *Machinery*, founded around 1912, carried many of the most interesting contributions. The journal was distinctly modern in its approach and favourably inclined towards scientific management even before the first world war. But none of the rest of the engineering press rivalled *The Engineer* and *Engineering*, and to a lesser extent, *Cassiers*.

### **Summary of the Argument**

Scientific management was the product of the most dynamic capitalist economy at the turn of the century, the USA. It was an expression of changes in technology and the labour process, business and management organisation, variously referred to as the scientific-technical revolution or the second industrial revolution. It was also a programme for driving forward such change. The use of work measurement to underpin a new type of incentive scheme is the feature of scientific management most commonly associated with Taylorism but this was only one aspect of a much more far-reaching change in the organisation and management of production.

Europe shared the experience of the scientific-technical revolution, but with important differences in timing and of degree and scale. Technical change and competition tend to create a unified world economy but the process is always uneven, never complete and encounters numerous conditions which ensure rich differences within that common experience.

This study investigates one strand of that experience, the influence of scientific management on the development of modern management practice in Britain in the



20th century. It does so by integrating a number of themes historically: the relationship between technology and management and between scientific management and management more generally; the management of work and the management of the worker; employers' strategies and the effects of worker resistance. The argument is that scientific management extends all the way from the development of production engineering to work study. Elements of a scientific management practice are apparent in workshop rationalisation before the first world war, and in the period between the wars new structures of management control were created alongside the spread of payment systems making more systematic use of time study. Taylorism, as one of the foundation stones of classical management theory and practice, was already an integral part of management before the second world war. As it actually developed as theory and as practice, Taylorism had little difficulty in accommodating other developments in management thinking from the human relations of Mayo to the behavioural science of the 1950s.

After the second world war, the use of work study became general throughout the economy, reaching a peak of influence at the end of the 1960s. Ironically, the spread of work study exposed its limitations as a technique for use with payment by results. At the same time, a plethora of new management tools found other means to continue Taylor's work. Work study became one technique among many, and Taylorism one element of a management practice which had long since developed beyond the point at which Taylor left it, but which rested on foundations he had laid.

We begin with a discussion of the changes in technology and associated developments in management thinking at the turn of the century (Chapter 1).

Taylorism had a mixed reception in Britain, welcomed in some quarters as an expression of modern trends and resented by more conservative elements for the same reason. Significantly, Taylor's British contemporaries in engineering emphasised his wider role as a production engineer rather than the particular significance of time study, which adds weight to the argument that a broader interpretation of Taylorism is appropriate.

Chapter 2 discusses the significance of early developments in workshop management practice and premium bonus schemes as the first, hesitant, partial and incomplete steps down the road indicated by Taylor. In chapters 3 and 4, we discuss the impact of these changes on the structure of management control and practice, and the division of labour within management and workforce. The main focus is the period between the wars but it is sometimes necessary to reach back to the late 19th century and to look forward to the second half of the 20th century to pursue these themes in detail.

In chapter 5 we consider the development of payment by results systems between the wars, the use of time study, the significance of the Bedaux system and the struggles it provoked. A postscript outlines the post-war history of work study.

It is clear that scientific management in Britain developed more directly from the management of mechanisation than from the activities of Taylor's followers and disciples. In the first half of the 20th century, the jig and tool designer and his successor, the production engineer, was more important than the efficiency engineer. But the direction of change was the same. In the 19th century the labourer was deployed around the skilled man; in the later 20th century the relationship is reversed with the skilled man deployed in support of the labourer



who now appears as direct labour or the production worker (Doray 1988:62). Taylor's time and motion study played its part but it was rarely the sole or even direct instrument of deskilling. It was a combination of processes which included the machine question as well as time studies and incentive schemes, new jigs and fixtures for producing simplified, standardised goods and detailed instructions from the office. Nor was it the *primary* function of scientific management to deskill the craftsman. It was simply that the craftsman was the biggest obstacle to the reordering of production. Scientific management aimed to transform the conditions of all kinds of labour and some of the toughest battles against the efficiency engineer were fought by women and semi and unskilled workers.

New management functions, directed by planning departments, reorganised work, routing, scheduling and directing the activities on the shop floor much as Taylor demanded. The new managers in the 'thinking departments' relegated the foreman to a position on the periphery of the production process along with the craftsman. But scientific management in any form developed only slowly and unevenly, as British business struggled to adapt to the demands of the newly emerging mass production economy. Nevertheless, before the second world war, new management structures were in place, time study was used more frequently and the Bedaux company had established a base from which it would build after the war.

That worker resistance could frustrate the labour process plans of the employers became an article of faith among critics of Braverman. This study discusses the struggle of engineering workers around the machine question and the grading of labour, and resistance to premium bonus schemes and the Bedaux system as well as the experience of piecework following the second world war. Its findings are really not very surprising. Workers could and did fight for discrete interests within



the labour process, but they were completely unable to change its character in any fundamental respect. To do so would have required a political struggle of a different order. They could get a better or worse deal out of any payment by results system but could not get rid of piecework, premium bonus or Bedaux. They could maintain for a period job controls and job monopolies over processes and machines, but they could not prevent the reordering of production from the office or the transformation of labourer into producer and craftsman into maintenance engineer. Such struggles made an enormous difference. They humanised what Braverman described as 'dehumanized prisons of labor' (1974:233) but worker resistance, as long as it was confined to trade union resistance, could only achieve a 'better bargain' (Price 1983:62). Workers arrived at a better bargain through struggle, the trade union by pursuing a deliberate strategy of collective bargaining.

If workers have not freed themselves from the labour process, capitalists have not always been successful in directing it. The Engineering Employers Federation determined to deskill work by redesigning the job, principally through changes to machinery and equipment, before putting semi-skilled labour on it. They were not entirely successful but there is little substance in the argument that British employers surrendered control of the shop floor by relying on piecework rather than 'Fordist' methods of management control (Lewchuk 1986). Premium bonus, piecework, Bedaux and work study were all designed to increase the intensity of labour. Piecework was just as common in America as in Britain, and the piecework systems which replaced premium bonus between the wars were intended to tighten time study standards. In the motor car industry, flow production was a consciously thought out process devised by talented engineers and piecework was used to support a systematic and largely successful attempt to determine work standards in ways which did nothing to surrender control.



Finally, on employer strategies, it is argued that the human relations of the industrial psychologists aimed to refine Taylorism not substitute for it. Arthur Lee and Sons, a pioneer of scientific management, welcomed Mayo's work at Western Electric and looked forward to combining financial and non financial incentives (Lee 1932). So did Urwick. The behavioural science of the post second world war was ostensibly more challenging, but work study, far from clashing with the new critics of Taylorism, offered to put its skills at the disposal of the human relations industry.

On the whole, Taylorism was absorbed into a rather unscientific management mainstream in Britain. Criticism of weaknesses in production management surfaced in the 1960s remarkably similar to those which animated the discussion of American competition in the 1890s and the reports of the Anglo American Council on Productivity in the 1940s. But British managers, like their counterparts elsewhere, based themselves on principles that Taylor had established.

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## Notes

- <sup>1</sup> Carter argues that Taylorism did not form part of management ideology and that its adherents today are few, 'Nevertheless the practical importance of scientific management was, and still is, immense' (1985:105)
- <sup>2</sup> 'The whole idea of planning shop operations in advance of performance was due to Taylor's influence and all modern planning departments are modelled more or less on his methods' (Bowie 1948)
- <sup>3</sup> Nelson goes so far as to argue that scientific management had little to do with the changing nature of industrial work, the worker, or personnel management but it 'was an important step in the evolution of modern manufacturing practice' (1974:500).
- <sup>4</sup> Fordist strategies in Britain were not helped by the failure to offer a right hand drive model until 1922, and Ford's refusal to sanction a small-bore, high- speed engine (Church and Miller 1977).
- <sup>5</sup> Voss and Robinson (1987) found few companies making serious efforts to implement just-in-time practice.
- <sup>6</sup> Ackrill (1988) argues that more could have been done at the level of the individual firm to overcome institutional rigidities.
- <sup>7</sup> Sayer is clearly wrong to suggest that Braverman believed managerial control and deskilling was 'a goal in itself' rather than one among many means to increase profits (1986)



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8 Tolliday and Zeitlin are setting up straw men when they assert, against radical economists, Marxists and others that, 'employers and managers must be treated as potentially autonomous historical actors whose substantive choices can modify as well as reflect their environment' (1991:2)

9 McLoughlin and Clark's comment that Braverman thought Taylorism was synonymous with capitalist management *in toto* (1988:67) oversimplifies and consequently misrepresents Braverman's argument. Clawson is more accurate in repeating Braverman's point that Taylorism 'dominates engineering, work design and top management - which together make up only one side of the work process' (1980:204)

10 J. Ehrenreich and B. Ehrenreich argue that *Labor and Monopoly Capital* was mainly criticised 'for failing to answer the questions it never raised in the first place' (1977:10)

11 P. K. Edwards argues that the Braverman debate comes to an end once worker resistance enters the picture and is seen as more than 'something which simply interferes with capitalists' goals' (1986:45). His conclusion that many of the issues raised in the debate have to be addressed in a new way is probably right in any case, but the evidence does not support the view that worker resistance prevented the reconstruction of the labour process along scientific management lines. Time-study men 'never truly succeeded in wresting control over production from the workforce' as the subsequent history of piecework showed (Noble: 1986:34). But the system of work and pay which provided the site of continuing struggles for control derived from the production organisation inspired by Taylor.

12 Studies found variations in effort rating of 12% and overall, the time study engineer's 'concept of normal varied from 30% tight to 30% loose' (*TSE* Jan. 1950; Desmond 1962).

## **Chapter 1      Technology, Business and Management**

### **Introduction**

In this chapter I will discuss the view that British economic backwardness at the turn of the century consisted, in part, of a failure to adopt modern management methods. In particular, I will examine the argument that the character of British markets was a major obstacle to the development of mass production and that the failure to rationalise industry accounts for employer neglect of Taylorism. I will show that employer conservatism and inertia in the face of existing economic structures and practices was as important as structural constraints but that arguments about the causes and consequences of British economic decline must be treated with caution. The performance of industry between the wars, or after the second world war when British economic decline accelerated, cannot readily be explained by the acts or omissions of the Victorians and Edwardians.

Economic and managerial change might have been sluggish and uneven but there was change nevertheless. Chandler observed that the most significant technological and organisational innovations took place in the metal working industries where 'the policies and procedures of modern systematic or scientific management were devised and perfected' (1977:244). In this chapter I will examine changes in the engineering industry after the flood of American machine tools onto the British market in the 1890s and discuss the relationship between the new technology and the development of new management methods.

Finally, I will discuss the reception in Britain for scientific management ideas and show that Taylorism was firmly identified by British engineers as an extension of technical and managerial changes that were already taking place in British



workshops. Hostility to Taylorism has been greatly exaggerated, but even in the writings of his most consistent critics it is possible to discern the conversion of the engineering establishment to scientific management.

### **Business Management and British Economic Performance**

Whatever the disagreements about the causes or long term consequences, the British economy was toppled from its dominating position in the world economy at the end of the 19th century by new competitors in Europe and by America (Bagwell and Mingay 1970; Landes 1969). And if the foundations of a modern economy had been laid by 1900, it took more than twenty more years for its shape to become apparent in Britain (Hobsbawm 1968:179). Mechanisation spread rapidly, but it was not until 1924 that factories, distinguished by their use of a power source, were more numerous than workshops (*Engineering* July 1925). Electricity generation was still quite a minor producer among the fuel and power industries in 1907. And while the numbers employed in the chemical and allied trades grew rapidly between 1881 and 1911, in 1907 they only accounted for 3% of the net output of industry (Ashworth 1960:78). In the new, science based industries, British producers clung too long to outdated methods or failed to develop new ones fast enough. The trend towards concentration of industry was slow too, and only really took off between the wars (Hannah 1974). The rise of the managerial firm was also slower in Britain; commonplace in the USA by 1914, it was still a rarity in Britain in 1919 (Chandler 1976:28).

It has nevertheless been argued that British business decisions were economically rational given resource constraints, the availability of cheap, skilled labour, and the character of British markets (Harley 1973-74; McLoskey 1970). But much of the literature which charts British economic performance and debates the causes of



relative decline is deeply critical of employer, or entrepreneurial, behaviour. For Landes (1969) and Aldcroft (1969), the failure of the British economy to grow as fast as her rivals before 1914 was due to a failure of entrepreneurial drive and vision. Particularly serious was the tendency to cling to old established processes and technologies. Levine (1967) too blamed 'weak entrepreneurial drives' for industrial retardation in Britain before 1914 and located them in the conservative nature of British society.

What many of these accounts also record is a parallel neglect of management (Simms 1981:146). Aldcroft argues that 'by 1914, rationalised methods of production and scientific management of the labour force had made only very limited progress in British industry' (1981:27). Even Payne, who finds the charges brought against British businessmen substantially unproved, points to the continued indifference, even outright hostility, to Taylorism and scientific management, as evidence of a lack of entrepreneurial vision (1978:218). Pollard too notes that the British were 'slow to adopt modern methods of internal management', and also cites employer hostility to Taylorism, though he observes that in all these areas, 'the continent was scarcely more advanced than Britain' (Pollard 1989:54)<sup>1</sup>.

I discuss below two features of this debate, the limiting effect of British markets and the socially conservative nature of British capitalism. But in general terms, the idea of British decline stemming from conditions at the turn of the century must be treated with caution. It overlooks the unevenness between sectors, pays too little attention to changes that did take place and gives too little weight to subsequent developments. The same conservative business behaviour might be rewarded in one case and punished in another. Dintenfass finds 'clear cut evidence of a British resistance to technological change' which hurt the iron and steel industry, but was a



matter of sound judgement in the case of cotton (1992:19-21). And despite the slow start made by the British motor industry, Morris and Austin were modern, competitive producers by the 1930s (Overy 1976:54)<sup>2</sup>. If the subsequent decline of this industry is related to the failure of the two big producers to rationalise capacity earlier (Rhys 1976), it can hardly be said to share a common historical backwardness with British industry in general, which accounts for a phenomenon of long term decline.

Every generation carries the burden of inherited structures and received wisdom which makes adaptation and change more or less difficult. Some attitudes and institutions may become more ingrained in the national culture than others, such as the contrast between British and German attitudes to education and training for example. And some of them feature in criticisms of British performance from the 1890s to the 1980s (*Engineering* 1899; Anglo American Council 1952; Roderick and Stephens 1981). Our attention is drawn to the difficulty of the industrial pioneer adapting to change driven from beyond its shores. But it was an experience which was uneven; more problematic in old industries than new ones; easier in terms of machinery than production methods; more successful in some markets than others. Each partial adaptation creating the conditions under which new challenges were to be met.

### **Markets and Management**

One major factor, for contemporaries and historians, has been the influence of British product markets. Gospel argues that the inadequate development of managerial hierarchies and control of labour in Britain contributed significantly to poor economic performance and that these failures are explained by two main factors; the nature of markets and employer strategies in externalising the relations

within workplace and firm. The argument is that 'the nature of product markets, in the 19th century and early 20th century, in particular their heterogeneity and degree of fragmentation, had a profound effect on systems of labour management in Britain' (1992:6). Market structures are mediated through the firm. Weak managerial hierarchies and inadequate corporate development together with employer choices of market (external) relations with employees rather than ones internal to the firm, help explain labour strategies in Britain and the problems to which they gave rise.

Zeitlin's argument, that engineering employers failed to transform the division of labour because of an absence of large scale programmes of capital investment and dogged craft resistance, is also heavily dependent on arguments about product markets (1983:26; 1985:228). Similarly, McKinlay and Zeitlin argue that British employers 'overwhelmingly rejected Taylorism as inappropriate for the high-quality, small batch production which again dominated British engineering after the Armistice' (1989:39).

This is clearly an argument of substance. It is beyond doubt that fragmented product markets and batch production discouraged the development of scientific management just as specialisation and standardisation encouraged it. Indeed, I argue that scientific management grew out of a systematic management response to the possibilities inherent in new forms of business organisation and new technologies. But Taylorism on this argument was both cause and effect: both a product of those wider changes and a force driving them forward. Markets are created as well as served. It may be that Ford could not have succeeded without the vast numbers of mid-west farmers in need of basic transportation. But his historical achievement, and that of a number of other mass production industries,



lay in devising production strategies which brought those markets into being and continued to help shape them even as they were supplied.

Britain and its markets did not exist in a vacuum. Designers in the British motor car industry might continue to demand greater accuracy in workmanship than the Americans, but by 1914 (if not well before) the Ford motor company had 'stamped itself and its product indelibly upon the minds of all classes the world over' (*Machinery* Feb. 1914). There was not much doubt after the turn of the century, even in the minds of critics, that the American system of manufactures represented the future, and that future existed in the here and now amidst all the clutter of the first industrial revolution. Nor was attention only drawn to engineering and the newer, mass production industries. The first issue of the *World's Work* in December 1902, a magazine devoted to 'national efficiency and social progress', carried a report of the achievements of 'A Yankee (Construction) Boss in England'. James C Stewart, it reported, had been called over to England to manage the building of the new Westinghouse factory in Manchester, and in so doing confirmed his reputation as a miracle worker (*The World's Work* Dec. 1902). He increased the number of men employed from 236 to 2,600, and the standard for bricklayers from around 600 bricks a day to a peak of 1,800. According to the *World's Work* it was a result of systematic organisation - detailed reports from 75 foremen and sub foremen being analysed daily.

The argument about whether American methods suited, or could be adapted to British conditions, was, of course, a question that was widely debated in British industry. Predictably enough, the advocates and practitioners of American methods dismissed objections about British conditions just as firmly as their critics advanced them. There were some cautionary tales from the newest industrial sectors which

could be cited in support of the view that one could not buck the market. Lanchester and Standard both suffered in the pre-war motor industry as a consequence of their early commitment to standardised interchangeable parts and lack of variety in design. In the electrical industry, British Westinghouse stuck too closely to American designs 'which they tried with little success to force upon the customer' (Saul 1962:41; 1960:32). But if attempts to imitate America could come unstuck examples of the adoption of modern methods suggest that talk of special British conditions could be an alibi for inaction.

The Rowan marine engine works in Glasgow provides an interesting case. Although David Rowan 'vigorously defended English practice and the position of mechanical engineering in Britain' from an attack by Orcutt at a meeting of the Institution of Mechanical Engineers in 1902 (*The Engineer* Feb. 1902), the Rowan works had, by the turn of the century, adopted a considerable measure of standardisation and advanced management techniques, including the premium bonus system. Rowan produced about twenty marine engines a year of between 1500 and 1600 hp for cargo ships but made a point of standardising the engines as far as possible, using accurate machining and interchangeable parts. The tool room had adopted the 'modern practice of having tool cutters ground and stored' for giving out to the men, and limit gauges of every kind were available. *Engineering* commented that it was quite a modern idea to introduce such refinements into the practice of making such powerful marine engines and that, 'Probably a certain number of orders are lost when firms insist on adhering strictly to their standard sizes and patterns; but this is more than compensated for by the economy that comes from repetition work' (May 1902).



Even where producers built on variety to meet particular customer requirements, and this was explicitly advocated as policy, there were considerable possibilities for standardisation of certain of the components. This in turn would give 'the opportunity of designing special tools for the purpose of producing the standard articles economically in the shop' (*The Engineer* July 1902). Orcutt's paper on 'Modern Machine Methods' took this argument further. The point about American methods, he argued, had been widely misunderstood: 'Many labour saving appliances could be adopted without changing the product of the shop in any way whatever' (1902). Orcutt was replying to criticism from J. R. Richardson from Lincoln who had argued that Americans did not understand British conditions. As a locomotive builder, his firm catalogued over 500 engines and had to take any work they were asked for.

Essentially the same point was put to James Rowan in the discussion which followed his paper on premium bonus in 1903. Mr John F Robinson pointed to the vast amount of detailed work involved in producing locomotive engines. The idea of having to fix standards for those operations appalled him. And anyway, they had to work to other people's designs and did not have the freedom to alter designs as a result of cost analysis. Rowan's reply was direct: 'He feared Mr Robinson had not studied the question properly ... (the speaker) thought that marine engines were equally difficult to deal with; in fact it had been his opinion that a locomotive factory was an ideal one for the introduction of the premium system' (*Engineering* April 1903).

The argument about what might be called standardisation in detail was also developed by the remarkable W. H. Maw, editor of *Engineering*, in his Presidential address to the Institution of Mechanical Engineers in 1901. Two things above all,



he argued, distinguished modern manufacturing practice. First, production to definite sizes with sophisticated measuring instruments for support. The second striking difference was the way production detail was determined in the office, 'exactly how its manufacture shall be carried out, the successive processes it is to undergo being specified, and the machines and tools used in them to perform these processes being fixed' (Maw 1901). Even firms where a great variety of work was undertaken could take advantage of modern methods 'if care is taken to resolve these products into their component units, and to classify these units, it will be found that opportunities exist for the introduction of standard parts and repetition work which are frequently entirely unsuspected'.

War production pushed such reasoning into the background and focused attention once more on the association between volume production, repetition and scientific management. But the argument surfaced again after the war. A report in 1921 on scientific management in the French shipyards at Saint Nazaire suggested that it 'dispels the notion of any indissoluble bond between mass production and scientific management' and underlined the point that conditions at Saint Nazaire were the same as 'in many machine shops in this country today, where mass production is definitely out of the question' (*The Engineering Review* vol. 23 1919). In the following year, a paper by J. W. Curtis to the Manchester Association of Engineers described the management of a medium sized business erecting more or less complete installations of coal carbonisation plant or gas undertakings. The management function was well developed with a design and estimating department, a general drawing office and a production department whose business it was 'to know every single item which constitutes the finished product'. Again, the argument was made that modern methods were not only applicable to mass production: 'The author stated that it was a mistake to assume that production



control could only be applied to mass production or speciality work. It had been shown in his paper that production control could be successfully applied after careful development in a works in which the articles manufactured were numerous and varied and the work further complicated by erection on site' (Curtiss 1922).

Finally we may note the testimony of A. P. Young, managing director of British Thomas-Houston works in Rugby, where scientific management was installed complete with rate-fixing department, motion study and the use of motion cameras as early as 1937. 'Our weekly production', Young told the 36th Oxford Management Conference, 'is about 30,000 castings spread over some 1,500 different designs. The very antithesis of mass production' (1937:153). Of course this meant adapting new production methods to meet more limited or diverse markets. But this was, after all, what the motor industry had to do too. Hence the distinction Woollard made between mass production and flow production, and the point made in the President's address to the Institute of Automobile Engineers in 1921. It would be a hopeless struggle, he argued, to compete with America as assemblers. The British market was more limited and demanded an individual touch, '...but even so we cannot hope to succeed unless we apply modern methods of production' (Watson 1921).

### **The Social Conservatism of British Capitalism**

The case to be made for the social conservatism of British capitalism is most often based on the supposed survival of the pre-industrial attitudes and an aristocratic culture which despised industry and mere money making. But it had much more to do with the conservatism of practical men determined, in the words of *The Engineer*, to 'make the best use of the means at hand', who continued to make money and win orders with existing equipment and methods. 'Of late years a great

deal has been written on the advantages of specialising in the manufacture of machinery', wrote *The Engineer*, 'but for many reasons ... it is undesirable, even if it were possible, for many engineering firms in Great Britain to restrict themselves in the variety of goods they offer to their customers' (July 1902). British business faced growing American competition but full order books was the principal reason why 'orders have gone abroad, and machinery and materials have been imported into this country' (*The Engineer* Nov. 1901).

At the same time, the example of America was pressed upon British engineering from every side. Its dynamism could not be ignored. In 1900 *The Engineer* responded with a classic statement of conservatism and one which speaks volumes for much British practice and a good many accounts of British economic and industrial performance which have been produced since. If there were an American Commissioner for Britain, argued *The Engineer*, he would find 'English methods to be in no degree less suited to England than American methods are to America' (Aug. 1900). England was a mighty tree. She had ceased to grow upwards, though she still towered above others, and was greater in 'girth and stability'. America, by comparison was a sapling, ceaselessly struggling to grow and compete, a country which would one day also become a great tree. You must start, argued *The Engineer*, from the patterns of trade and traditions of a country before pronouncing on her methods. When, in fifty years time, America herself was overtaken, 'will they utterly cast out the ways of their fathers and grandfathers - will they be able to stamp out tradition and overcome hereditary ideas and spring up fresh and green from their ashes? No, and a thousand times no. They will do what England is doing. They will make the best use of the means they have at hand'.



The manufacturer most affected by the 'goblin' of American competition was the least concerned by it because he was making money. If he retained his old tools it was because they were 'a very important consideration; secondly they do the work as fast as he wants it done; and lastly they are cheap to use. Thus it is with hundreds of our 'antiquated' ways, both in making and selling'. English methods worked because they were there and they made money; change was problematic. A correspondent wrote in to point out that America 'pulled down many edifices and shops just because a new one would save more time and labour' and many of those scrapped tools ended up in British factories (Nov. 1900). But *The Engineer* was not shaken in its conviction that there was little alternative to making the best use of what was at hand. As late as 1927, yet another report on America inspired the forlorn hope in the editorial office that 'it may be the last of such productions' and a response remarkably similar to that delivered twenty seven years earlier. Many people had launched diatribes against Great Britain because 'she is not as America is'. But, in two to three centuries time (the horizon had shifted), America would find herself where Britain is now, 'she will have to suffer comparisons with some new nation given by Providence vast possibilities, unhampered by a long tradition, uncontrolled by a 'fixed genius' and free from that resistance to rapid changes which is the constant and natural accompaniment of age' (April 1927).

It was a penetrating and lucid expression of the relationship between Britain and America, between traditional ways of doing things and radically new methods that would have drawn sympathetic approval from many in business and angry impatience from others.

It would have infuriated that leading British theorist of management between the wars, Lyndall Urwick, one-time manager at Rowntree's plant in York, director of

the international management institute at Geneva and author of numerous books and articles on management. Urwick was fond of quoting the historian, Philip Guedalla, on certain British characteristics: 'A happy inability to apprehend general ideas appeared to stand between the people of England and their disturbing impact ...The pursuit of theory was left to professed theorists, while an obstinately practical community eschewed the primrose path of general ideas and confined itself austere to the solution of practical problems' (1956:25). Scientific management was a general idea and the British had allowed it to be obscured by a determinedly empiricist outlook, by 'minds so pre-empted with technical issues that there was little room for the seeds of more effective management' (Urwick and Brech 1957:102,120).

But it would have been perfectly understood by the 'practical men' at Courtaulds. Samuel Courtauld IV might be a signatory of Mond's letter to the TUC but hostility to unions was maintained, on the ground, at the plants throughout the 1930s (Clegg 1985:469). In 1937, Courtaulds hired consultants to investigate the company's purchasing system. Courtaulds' historian, Coleman commented, 'This characteristically American move would have horrified the older generation of British directors of Courtaulds. Scientific management, business efficiency systems, time and motion study .... all remained anathema to the old school' (1969:455)<sup>3</sup>. Coleman's discussion of the culture of 'gentleman and player', of the educated amateur and the practical man, is revealing. The practical man could be more conservative than the educated amateur but together 'they could and did perpetuate inertia in business because both parties to it had a built in distrust not simply of 'science', but of any theoretically based knowledge' (1973:113).



It seems certain that the conservatism of practical men slowed the pace of change and inhibited the adoption of more modern forms of production and management. It may be, as Phelps Brown has suggested, that the very success of older methods made managers reluctant to learn the new, that 'The minds of practical men became bounded by the processes and products that they had mastered in long apprenticeships' (1977:25). But slow adaptation to change did not prevent change taking place. New American tools in engineering began the process of re-equipping British workshops and British engineers were discovering for themselves that the management of mechanisation demanded new methods as well as new technologies.

### **The Management of Mechanisation**

The 1890s were a crucial learning period for British industry. At the beginning of the decade there was considerable complacency. A special meeting of the Manchester Association of Engineers heard a report following a visit to America which criticised American machinery for being too light and for striving after 'mere novelty', American goods for lacking quality and American production methods for relying on sub contracting, which had 'long ago been abandoned' in Britain. The visitors had seen electric welding machines in operation in Boston but did not believe they would ever be a commercial success (*The Engineer* Dec. 1890). Confidence in British machinery was boosted later in the decade by the development of high speed steel requiring heavier machines, but American machine tool makers were quick to respond and their mere novelty - actually, labour saving attachments - enabled exports of four leading USA manufacturers to grow in value from £86,165 in 1895 to £337,528 by 1897 (Saul 1960:23; Floud 1974:70).

By the turn of the century coverage in the engineering journals of the challenge from America reached a new level of intensity (*Engineering* 1899). 'The sober truth is', wrote Louis Cassier in 1900 during an enquiry into American competition, 'that in machine shop methods Britain has fallen behind Germany, and America has shot ahead of Germany' (1900). There were still flattering accounts of British practice by Americans (Sweet 1896). But the tide was definitely running the other way. European machinery was criticised for its academic design, being constructed with only a 'superficial knowledge of shop practice' (Binsee 1899). The great mistake made by Barnes and the ASE, *The Engineer* now discovered, was to have underestimated the revolution in methods of production which began in the USA: 'We see daily being introduced into workshops and shipyards, tools and methods which have been in almost universal use in the United States with great advantage for months and even years' (Jan. 1898). By the end of the year *The Engineer* had concluded that English manufacturers could no longer profess 'to despise American methods' (Dec. 1898).

All observers were impressed by the use of specially designed jigs and templates in American workshops which enabled cheaper labour to produce more accurate work and were aware of the contrast with Europe (Smith 1894; Grimshaw 1895). But they were equally impressed by American management. In a widely reported account of American practice by a Belgian engineer, the emphasis was unmistakably on methods rather than technology. Three facets of American practice were discussed in detail. First, the idea of simplicity and uniformity of the product together with the use of cheap materials - the finish on American goods was only what was required in terms of function. Secondly, workshops were more highly mechanised with more self acting and better quality machines. And thirdly, the methodical system of working was noted and related to the development of the



management function: 'I was shown administrative offices invested with plenary powers. Among their duties were not only the making of plans, but also the giving of necessary instructions to each department, forge shop, pattern room, foundry, iron and steel store houses, shops etc.' (Francois 1896).

There was some catching up in British engineering in the first decade of the 20th century. The performance in textile engineering machinery and locomotive manufacture remained impressive (Saul 1970). And if American competition still exposed the backwardness of traditional engineering methods, there was nevertheless 'evidence of a renaissance in engineering generally at this time' (Saul 1960:36; 1962:39). There was renewed confidence among tool makers. By 1900, Herbert was producing twenty different kinds of milling machine for use 'in almost every branch of mechanical industry' (Herbert 1900). In 1901, *The Engineer* was struck by the quiet confidence of British manufacturers given the advance, in Britain, of 'specialisation and the adoption of the higher methods of manufacture', including the use of 'rigs and jigs'. There were even claims that the whole of the British machine tool industry had learned from the American invasion of the 90s and that high speed steel tools were being taken up more quickly in Britain than America (Coxon 1909). That there was some basis for this optimism is suggested by the slower rate of growth in imports of American machine tools in the first decade of the 20th century (Saul 1960:26).

By the turn of the century then, British workshops were acquiring the latest machine tools and British firms were now significant producers of them. But the source of American competition had never simply been a higher level of mechanisation so much as the way production was organised and managed. American manufacturers were careful of the worker's time to a remarkable extent

(Gimson 1905); in English workshops labour was wasted with every part 'finished with equal care and accuracy, regardless of its relative importance' (Blount 1906). The contrast between American and European foundries, another observer noted, 'was the great stress laid upon system and organisation in the strictly modern establishments' (*Cassiers* vol. 29 1905). The Birmingham manufacturer, H. L. F. Orcutt, a fierce critic of British engineering performance returned again and again to theme of American management. Even if Britain fully caught up technically, 'It is the *profitable* operation of good plant that is generally not understood in England and in which America leads' (1902).

British manufacturers found it easier to import American machines than American methods, but while those machines could be - and often were - operated in a workshop which remained largely unaltered in almost every other respect, the technology created new pressures for changes in the division of labour, not only on the shop floor, but in the office. These connections were grasped much more quickly, and acted upon, in America by systematic as well as scientific managers and were more important than the technology itself in guaranteeing American economic leadership. But even in Britain, business was being driven slowly, painfully and unevenly down the path already trodden in America.

### **Management and Technical Change in British Engineering**

Changes in engineering technology have been well documented. In the early 19th century, the all-round skills of the millwrights began to be broken down into separate trades, including those of turner and fitter, which survive into the 20th century as the basic skilled occupations. Put crudely, the former shaped the metal parts and the latter made them fit. While both fitter and turner of the 1850s would have been at home in an engineering workshop at the beginning of the 90s, things



changed rapidly thereafter. The fitter's job was split into 'erector, bench fitter and tool and gauge maker' (Jefferys 1945:124) - and one might add, eventually, assembler - while the turner confronted a host of new processes for turning and shaping metal including capstan and turret lathes, vertical and horizontal millers and borers, surface grinders and radial drills. The turret and capstan lathe was developed in a variety of forms. The turret could slide up and down the lathe bed horizontally or revolve so that one tool after another was brought into contact with the workpiece. 'With the introduction of 'stops', so that the tool can only begin to work in the right position and automatically disengages when its work is finished, we have the semi-automatic machine which can be operated by any man after a few hours instruction, once the machine is 'set-up' for the job (Rowe 1928:265).

In a sense the new machines were not new at all (*Engineering* April 1897; Landes 1969:309). 'Turning, milling, planing, grinding, and boring are as old as the hills,' wrote Orcutt. 'It is the latter-day developments of these operations in which the progressive manufacturer is interested, developments which have practically taken place with the last twenty years, some of them within the last five years' (1902). Those latter day developments included new grinding materials and the critical breakthrough of high-speed steel but in the main they were of two types. First, a series of small improvements, tending to semi or automatic operation, which changed the nature of otherwise familiar machines and the development, alongside the machines themselves, of the jigs and templates for standardised output and the limit gauges which substituted the idea of interchangeable parts for a 'dead fit'. It is, of course, the trend to specialisation by manufacturers in a select line of business or limited output range and the accompanying standardisation of the product to cheapen production of larger quantities - the key business changes at the turn of the century - which drives and is driven by such technical change. The management

of new business strategies, mechanisation and the management of labour were all bound up together.

Arthur Horner, who wrote extensively in the engineering press, described how in the revolution of recent years the craftsman had become 'merged and obliterated in the machine' (1899). The turret lathe with its stop mechanisms meant that 'each tool in the turret is limited and arrested without any care on the part of the attendant'. Milling machines were replacing planing, slotting and shaping machines in a number of operations and accurate grinding meant that 'cutter and tool grinding is done to precise angles, without skilled attendance'. Increased speed and accuracy in result was apparent everywhere, much of it dependent on the new use of jigs, templates and gauges. A new division of labour was growing up in the wake of such technical development: 'From all this specialisation of machines, and the use of jigs, templates and gauges, there follow as a natural result, much division of tasks and separation in the shops ...In the modern machine shop the tools are ground by men who do no machining or fitting, while those who fit seldom carry out the final adjustment, assembly and erection of the complete mechanism'.

As early as 1891, *Engineering* complained that with improvements in machinery and in milling cutters in particular, 'the cutting speed is frequently quite neglected, and the rates of rotation, given by the various speed cones of the machine, are comparatively seldom known by the workman. Consequently the machine is usually run at a speed determined by the merest chance' (Oct. 1891). But the development of high-speed steel tools 'disturbed the equilibrium' of the shop in a variety of directions (*Cassiers*



vol. 35 1908). There were now many different methods of machining and choice of tools available to produce the same engineering result but with considerably different cost implications. Turning may be more profitable than forging; loading and setting a machine may be more costly than the actual machining. The development of cost accounting in Britain was encouraged by the move towards production decisions based on cost rather than technical considerations. And the decision about which method was most cost effective could only be arrived at after more systematic study.

High-speed steel tools 'at once rendered the machinists' traditional knowledge of proper cutting feeds and speeds obsolete' (Montgomery 1989:231). They opened up dramatic new possibilities and widened the knowledge-gap opening up between shop floor engineers and a growing body of production specialists and managers. In 1905 Horner described them as 'the greatest innovation in workshop practice which the present generation has ever known'. Cutting speeds which had remained little changed for fifty years could now be doubled, trebled and quadrupled (Horner 1905). It was claimed that the text book speed for machining cast iron was 15ft per minute. In practice this might be pushed up to 30ft but high-speed steel made speeds of 90ft per minute possible. Mild steel could be machined at 130 foot per minute against the text book figure of 25ft. But, 'Not all our mechanics, nor alas, our foremen can give the cutting speed of the different diameters they may be engaged on; and our older hands, who instinctively know the proper speed for the old tools, are at sea in judging from sight the proper speeds with the new steels' (Fielden 1904). An article in *Cassiers* magazine noted dryly that time must have hung heavily on the hands of the operator of twenty five years ago, drilling at the rate of one

third of an inch per minute, when a modern machine 'will drill a one and a half inch diameter hole in cast iron at five inches per minute. Six rates of feed are available, instantly changeable ...'(Coxon 1909). And when electric motors were used to drive machines directly, Horner noted, changes of speed could be more easily accomplished and then, 'The workman will have no plea to urge against making repeated changes in speeds to suit work of different diameters' (1905).

The separation of specialised and more highly skilled work in the toolroom was further encouraged by the special maintenance necessary for the new tools. Reporting the high speed steel tools exhibition in Paris, *Engineering* noted that such tools should be ground to definite angles 'the most suitable of which have been selected as the result of an extensive series of experiments' (May 1902). It was a practice resented by many skilled men and at Thorneycroft's, on F. W. Watson's account, the skilled men successfully defended their prerogatives over the tools (1935:92). But their victory can only have been temporary. The toolroom had arrived to stay. It was not, however, simply a technical matter. A finer division of labour which prevented the waste of time and material 'caused in the machine shop by workmen running to and from the grindstone, and grinding tools to any angle, usually the one that gives the least trouble' was an additional, and no less important, consideration (Carnegie 1900).

At the opposite end of the workplace, the drawing office was taking on a new role. The drawing office had always produced designs. 'Now, the drawing office is looked upon not only as the "designing" department, but as the "thinking" department concerned a much higher level of detail, including



the methods of production and the jigs and special tools that would be necessary' (Herbert 1919).

The new men setting feeds and speeds and dictating the angles at which tools would be ground were intensifying labour by speeding up the process. Employers were warned not to allow men to work at a traditional pace. Oberlin Smith criticised the 'crying evils' of slow speeds, shallow cuts and narrow feeding: 'Do not allow a workman to think that sixteen feet cutting speed per minute on soft cast iron is "good enough" because he did it yesterday or last year, or because his grandfather did it' (1895). Smith claimed that he had been able to cut the time taken on two boring operations from five hours and nine hours, to half an hour each.

Taylor's point that the benefit of high speed steel tools would be lost under the old system of management 'in which the machinist is left with the final decision as to what shape of tool, depth of cut, speed and feed he will use' was not lost on an English audience (*Mechanical World* 1907). The point was made again and again, 'the manual worker should not have any avoidable head work' to do (Thomas 1908). The immediate practical effect of the separation of conception from execution, encouraged by these developments, was felt through the new job cards laying down details of how the job was to be done and in the growing specialisation of labour. Its wider effect was in the growing divorce of the skilled engineer from the larger questions of production planned from the office. Alexander Siemens' Presidential Address to the Institution of Electrical Engineers in 1904, expressed what was becoming a common opinion when he argued that developments in engineering had divided the workforce in two: 'a large

majority that shall have no need to think, or to use their brains, and a small minority, who must think very hard all the time' (*Engineering* Nov. 1904).

In two quite remarkable editorials in February and June of 1903, *Engineering* brought together the trend towards mechanisation and division of labour with the new task of management conceived as mental labour. 'The secret of successful engineering production is that the thinking shall be confined to very few minds, and that they shall not only think very hard, but shall also think in conformity to one central idea or system of ideas' (Feb. 1903). Too many engineers associated modern manufacturing methods simply with automatic machinery: '.. we have emphasised the point that modern manufacturing methods are more a matter of management than machinery... Modern methods are mental not mechanical in their essence. They have their seat in the intellect of the manager'. The craft of the ancient millwright, who designed, planned, constructed and fitted the article that he made, had no place in the modern world. The bad old system was one 'in which each workman was allowed to decide what constituted a fit and to attain it in what way he thought best. Modern manufacturing methods imply the laying down of principles to which all must conform...'. The millwright in fact provided an inverted picture, a photographic negative, as it were, of modern, economical methods. Opposition could be expected from both the foreman and the machine minder, both of whom would rebel against this rule which could only be enforced with an iron will. The main thing was 'to make the heads of departments think out each point completely and to prevent the workman thinking at all'.



In June 1903, *Engineering* returned to this theme, arguing once again that the key to modern methods was management not machinery. A profitable engineering shop could be more easily obtained with old machinery and modern management than with new machinery and old methods. There was a link between them of course: 'Modern machines demand modern methods of management, and without them they are doubtful investments' (June 1903). Management cost money. This was sometimes not understood by accountants who could more easily quantify the savings from the purchase of a new machine than altering designs to standardise on one component. But it was management, a directing will, that was needed to reduce engineering construction to mere manufacture. Such a step required a quite different relationship between the foreman and the men: 'Modern methods of manufacture demand more and better foremen than the old system, because their essential principle is that the machine man shall not exercise any discretion at all. The foreman now has to think for every man beneath him ... In spite of the perfection of mechanism which is the mark of the age, brains are still the most important part of the equipment of a works. Formerly every man was expected to be intelligent and thoughtful; now the mechanic is being displaced by the labourer, and the thought which he had to expend on his work has to be provided by the foreman'. It is hard to believe that the editors of *Engineering* had not just finished reading Taylor's *Shop Management* published in 1903.

### **The British Reception of Scientific Management**

Urwick and Brech (1957), the historians of scientific management, have suggested that employers and managers were cool towards Taylor before 1914 and that the technical press paid him little attention, ignoring his book *Shop Management*



completely. More recently Locke has made the same point asserting that, 'An analysis of British engineering periodicals shows a lack of curiosity before the first world war about the new management being perfected across the Atlantic' and that what did appear 'indicates that the British engineering profession did not really understand modern management' (1984:98). The apparently hostile reception Taylor received in Birmingham on the occasion of his visit in 1910 and the criticism of employer like Cadbury, have served to complete the picture of ignorance, indifference and hostility which scientific management met in Britain before the first world war. It is a picture which must be substantially modified.

First of all, the engineering press did not ignore Taylor or the new management. As we have seen, discussion of management as a key factor in creating the success of American economic competition was commonplace. The quality and detail of the discussion in American journals was far in advance of anything in Britain, but it should be remembered that Taylor, though known, was not notorious in America or Britain until the sensation created by the Eastern Rate case. And that case did generate substantial attention in Britain.

There were are numerous references to Taylor and his work in the engineering press. Some were direct references to his papers, others passing references suggested by other contexts. Other Americans associated with scientific management like Gantt, Gilbreth and Emerson were also brought to the attention of a British audience. *Cassiers Magazine* reprinted Taylor's 'A Piece Rate System' in 1895, and *The Engineer* reprinted it in three parts beginning in April 1896. In 1898 *Cassiers* reprinted Taylor's 'A Partial Solution of the Labour Problem' with the comment that Taylor's work at Midvale was worth studying 'in view of the demonstrated excellence of his system'<sup>4</sup>. In 1905, *Engineering* carried a substantial



account of Taylor's piece work proposals including the inevitable story of Schmidt and the pig iron (Sept. 1905). And in 1907, at least four publications carried his 'Art of Cutting Metals' (*Engineering* Jan. 1907; *Cassiers* vol. 31 1907; *Mechanical World* Jan. 1907; *The Mechanical Engineer* Dec. 1906). There seems little justification for Urwick's comment that management questions were ignored in favour of technical ones and that there was a temporary halt to progress between 1900 and 1914 (1938:20).

Urwick and Brech also suggest that the British were only interested in the technical aspect of *The Art of Cutting Metals* (1957:93) but in fact interest went much wider. It is true that *Engineering* was mainly concerned with technical matters in its comment in January 1907, though it did note that Taylor's work began with a conflict with the men at Midvale over a fair days work and went on to argue that the ordinary turner has only 'vague notions as to the maximum output possible with his machine' and that operating speeds could be doubled if feeds and speeds were fixed for him. In February, however, *Engineering* returned to the theme in a way which shows just how familiar Taylor and his ideas were. Referring to Taylor's proposals the editors wrote, 'We have on various occasions indicated the main features of this plan, but in view of the extraordinary results which have in many instances been obtained with it, we have little hesitation in again dealing with the matter'. And it was clear that they knew precisely what they were talking about: 'The essential basis of the system is the putting the management in a position to know more thoroughly than the workman himself the best it is possible for him to do, and, armed with this knowledge, to lay down for him in detail the precise course of operations, and the tools, if any, which he is to use in executing any particular piece of work' (Feb. 1907).

*Cassiers* comment on the lesson of 'The Art of Cutting Metals' was that 'scientific methods of remuneration' needed to be introduced and *The Mechanical World* linked the article to Taylor's *Shop Management*.

Gantt probably attracted as much attention, perhaps because he was associated more with payment systems. *The Engineer* reported his work at Bethlehem in February 1902 and *Cassiers* carried Gantt's article on 'Equitable Labour Compensation and Maximum Output' in 1904. In the same year *Engineering* printed an article from Emerson, 'A Rational Basis for Paying Wages', and in 1907 *The Mechanical Engineer* and *Mechanical World* reprinted Gantt's address on 'The Economical Utilization of Labour'.

Indirect references to the pioneers of scientific management are scattered throughout the press. To cite a couple of examples: *Engineering* reported the introduction of the differential rate at a Huddersfield firm in 1905, a system 'introduced from the United States into several works in this country' (Sept. 1905); *Machinery* referred to Taylor's work and 'annihilation of rule of thumb' in a book review in April 1914 and *The Mechanical Engineer* reprinted two American articles on shop management and payment systems in 1910, both of which referred to Taylor (Waldon 1910; Dickie 1910).

An analysis of the engineering press does not support the view that there was ignorance of Taylor or indifference to his ideas. In 1914, *Machinery* defined scientific management as the 'application of common sense' and advised firms to train their own men in the shop rather than use outside efficiency experts (*Machinery* June 1914). And though there was some hostility, Taylor's visit to Birmingham is not a good example of it. Taylor was in attendance at a discussion



of a paper by H Brackenbury on high speed tools, at which a British engineer, Dempster Smith, had criticised Taylor's calculations in '*The Art of Cutting Metals*'. Taylor's response was to say that the Proceedings of the American Institute 'were already burdened with everything he wanted to say on the steel', and went on to describe in great detail, Gilbreth's bricklaying experiments. Brackenbury's reply, that machine builders are always studying the motions of men seems remarkably polite in the circumstances (*Engineering* Aug. 1910).

There was hostility to the specific programme of scientific management and nowhere was it expressed more consistently or forcefully than in one of the principal engineering journals of the day, *The Engineer*. Its opposition provides both a fascinating study in conservatism and a measure of the gradual acceptance of scientific management as the editors are forced to accept that they have become 'a voice crying in the wilderness'.

In May 1911, following the publication of Taylor's book '*Principles of Scientific Management*', *The Engineer* declared that Taylorism was unfair and inhuman. It was not 'sportsmanlike'. Interestingly enough, it was precisely those developments already identified in Britain, the separation of thinking from doing, which was *The Engineer*'s target. Taylor had 'made a central office, the route-ing office, do all the thinking, and he endeavoured as far as possible to make the men machines' (May 1911). 'Route-ing' was a punishment for convicts, not fit labour for a free man who should be 'free to exercise his intelligence, something to make him higher than the machines he uses, and to give him the right still to call himself a man'. In April 1912, *The Engineer* returned to the attack on Taylorism, describing it as '.. scientific management gone mad. It means excessive "motion study" and "route-ing" and "stop-watching", and all the other schedulings which take time and men in



American workshop management' (April 1912). No question of profit could justify reducing humanity to the level of a beast of burden.

The editors of *The Engineer* may have been influenced by reports of labour troubles in America and by the great unrest before the war in Britain. Edward Cadbury certainly was when he made his celebrated critique of scientific management in the *Sociological Review*. 'Reducing the workman to a living tool will either demoralise the workman or lead to social revolt', Cadbury warned. 'Our whole system of social, industrial and political life rests on the idea and practice that management and control are in the hands of the middle classes and the rich. The controlling positions in the army and navy, in the civil service, and in all the professions are practically barred to the workers, and the growth of the Labour Party and Trade Unionism, and even Syndicalism properly understood, are expressions of the workman's demand to control his own life' (1914:105). Cadbury's solution was firstly, to avoid pressing subdivision of labour to the point of 'eliminating any little judgement and initiative as to the methods of work' which workers exercised, since this would anyway damage productivity in the long run. And secondly, to encourage the development of collective bargaining, trade union organisation and employee involvement. The unions in particular should be educated to accept 'this new industrial advance'.

Cadbury of course was a leading Quaker employer and fully committed to a paternalist welfare policy. But for all his criticisms Cadbury was closer to Taylor than either would admit. At Bournville, there was a relatively well developed management function which included welfare and personnel policy, careful selection of employees, a suggestion scheme and education for employees. It also included detailed organisation of work and a system of work study in which the



firm 'make a study of every piece of work and the operations involved to determine what is a fair task for the average operator, so that the rates will not have to be altered unless some new machine or method is employed' (Cadbury 1914:114; Rowlinson 1988). Hans Renold, who also took part in the discussion as a straightforward advocate for scientific management, was in no doubt. He thought Cadbury had taken it much further than he himself had.

In what was turning into an annual assault on Taylorism, *The Engineer* returned to the fray in April 1913. Anticipating Cadbury's worries about productivity, *The Engineer* argued that 'In advocating such systems the fact is frequently overlooked, that the main source of all industrial advance has been in fertility of resource, and keenness of observation of the individual, and that any development which depreciates originality of thought or lessens the value of life long experience is bound to end in a lowered efficiency of production' (April 1913). At the same time, in the spirit that Taylorism was 'scientific management gone mad', it was admitted that a 'modified system, carefully applied' might be appropriate. In November of the same year however, *The Engineer* attacked the assertion of the American Society of Mechanical Engineers that labour saving scientific management methods had been adopted in a whole range of industries. We all practise labour saving management, argued *The Engineer*, but Taylor and Gilbreth stood for something quite definite, 'At the back of the minds of both of them is the conception of a factory as a huge machine tool' (Nov. 1913). The workers were its parts. The management 'the cam wheel that controls them ... The lubricant is the bonus'.

What is interesting about the opposition of *The Engineer* is the emphasis placed on those more general extensions of the management function, arising out of increased specialisation and the scientific-technical revolution, summed up in the notion of

'route-ing'. American methods won't work here, argued *The Engineer*, because the workers of Scotland and England won't put up with the route card. It is precisely this aspect of Taylorism which was developing fastest in Britain and which obliged even the increasingly intransigent editors of *The Engineer* to contemplate a 'modified system, carefully applied'.

The other main engineering publication of the day took a different approach. In 1905, *Engineering* had welcomed Taylor's remarkable system and recommended a combination of Rowan's premium bonus and Taylor's time study (Sept. 1905). But *Engineering* too, developed a critical line in the discussion before the war, although its opposition was short-lived. It too, saw Taylorism as the managerial consequence of increased specialisation and sought to modify its extremism.

In June 1911 *Engineering* criticised the 'task work system' for treating workmen like machines and in September, attacked Gilbreth's prescriptions for motion study, 'A man is not a machine and no good can come from trying to make him one ... it is difficult to persuade oneself that good can come from going out of one's way to cramp the worker's personality, not only by means of the appliances he uses, but also by means of a rigid control of the motions of his body'. Those who opposed it should have 'little fear that we are on the eve of a revolution in our industrial methods' since the unions were sure to oppose it (Sept. 1911).

However, in March 1912, *Engineering* was describing the revolution which had *already* taken place, which consisted in removing from the shop to the office all questions concerning the design of the product, and locating scientific management as 'a tendency towards further specialisation'. 'Scientific management then proposes that the work of manufacturing shall be further specialised, and that instead of the



system in which a job is designed by one man in every detail and made by another, we shall substitute a system in which a job is designed by one man in every detail - that is, the machine it is to be made on, the tools that are to be used, the rate the machine is to be run, the time the job is to take etc. - and finally passed to a third, who shall do the actual physical work'. What was being described here was the development of production engineering, or production management and *Engineering* was incapable of rejecting such a development in its entirety since it had identified and welcomed just such a trend in Britain. Its thoroughly British objection was to the extremism of scientific management, 'Few doctrines will stand pushing to their logical conclusions in this world, and compromise lies at the root of most material success' (March 1912).

From America, William D Ennis, of the Polytechnic Institute, New York, wrote to say how disappointing it was that *Engineering*, widely regarded as the *Times* of the engineering profession, should take a position which made no more sense than opposition to Watt's steam engine would have done - the 'Thunderer' had got it wrong (Dec. 1911). Gilbreth wrote responding to a critical review of his book, accusing the editors of reproducing the criticism 'we confront daily from employers in carrying out our work' (Oct. 1911). To all this, and a correspondence on motion study running through 1912, *Engineering* replied that 'where we differ from Dr Taylor and others on scientific management is not essentially in the methods it stands for, but on the extent to which those methods should be carried. We think a large part of the professional opinion in this country agrees with us in this' (June 1913).

The experience of war dispensed with such reservations. By 1916, *Engineering* was recommending the Taylor system to guarantee the intelligent workman the

gains from increased output, 'In this connection the adoption of the Taylor system of time and motion studies, if applied with due consideration and discretion promises to do away with much injustice' (Aug. 1916). Three years later, W. H. Maw, the senior editor of *Engineering*, moving a vote of thanks for the Presidential address at the Institution of Mechanical Engineers, thought it regrettable that motion study had been ignored, though he welcomed the fact that it was now making slow progress here (Oct. 1919). The conversion of one part of the engineering establishment was complete.

*The Engineer* was not so easily moved. In 1916 it urged its readers to remember that it was possible to be carried away by efficiency to the point of losing all sense of beauty or happiness. There had to be improved machinery and work should not go through the shop without order and direction but even so 'each workman should be permitted in his own little sphere, at the bench or the machine, to express his own individuality in his own way of doing things' (Dec. 1916). But even *The Engineer* had to recognise that 'It is crying in the wilderness to say all this at present. Nowadays one has got to show that every action is worth while, that it is made with the sanction of a motion diagram according to Taylor, Gilbreth and Co.'<sup>5</sup>.

In 1921, *The Engineer* broadened its attack on 'the tyranny of human efficiency' which was proving so destructive of human happiness (Nov. 1921). Men were condemned to repeatedly stamping metal parts without even knowing what they were for. And it was spreading '... the same thing is going on now in thousands of factories, and is extending daily as efficiency methods and mass production increase'. And the following year, the magazine was poking fun at the works organiser who would be in ecstasy at 'the forms, schedules, dockets, index cards



etc. etc. that would make the simple transaction a work of organisational art' (April 1922). It was also increasingly out of tune with the times. In 1927, *The Engineer* had to admit that 'The success of American labour methods is no longer in question' (Oct. 1927). And ten years later, its delight at public criticism of Taylorism only served to illustrate how influential scientific management had become. 'Taylorism,' *The Engineer* noted, 'has won so much attention in the industrial world since it was introduced over forty years ago that even those who do not adopt it, even those who disbelieve in it, hesitate to treat it with disrespect' (March 1937).

By 1914 virtually all the main technological changes which would underpin the inter-war growth of the mass production economy were in place. Mechanical handling of all kinds, including various uses for conveyors, had spread very rapidly from the 1890s. By the mid 1920s it was possible 'to deal mechanically with any class of goods under almost any circumstances' (*Cassiers* vol. 12 1925).

Unmechanised conveyors were common in the car industry in the early 1920s, and mechanised ones in the early 30s. But their use affected many industries and different types of labour from 'coal bunkering' at British ports to handling cases of soap and laundry. And their effect on labour was usually more immediate and dramatic. At the Standard Motor Co. in Coventry, assembly line operations made it necessary 'to split up operations which were formerly performed by one operator, between several operators, and in others to have twice as many if the time taken is double that of the standard time for each of the other operations'. At the Loud and Western laundry in Wimbeldon in 1926, the use of conveyors to carry laundry to women workers was found to have a number of advantages: 'The workers are separated, thus preventing confusion and the annoyance of talking and "visiting" among employees. When the operator is in the booth she can deal with the work

with the fewest number of movements, handling each piece but once, and with no cross over of hands' (Zimmer 1926). Work study did not reach the laundry industry in a significant way until the 1940s but clearly, elements of scientific management had already arrived.

Finally, we might note that *The Engineer's* hostility to Taylorism also serves to illustrate how the job of the engineer was changing from a purely technical one, to one with a commercial/managerial dimension. It was of course, something *The Engineer* regretted. There was something wrong with a system which diverted a trained engineer into administration (Dec. 1921). 'The business man', protested *The Engineer* in 1923, 'is beginning to dominate the engineer'. Commercial education had gone too far. Young men were having to learn too much science and 'will be expected to attend lectures on, and pass examinations in, labour problems and the organisation of mass production factories' (Dec. 1923).

## Conclusion

In this chapter I have suggested that the social conservatism of British capitalism almost certainly slowed economic change. At a minimum, Maw's discussion of standardisation in detail showed that there was more scope for modern manufacturing methods than was often admitted. It was a conservatism which could be complacent and yet, at the same time, uncomfortably aware of the inadequacy of older structures and practices for dealing with competition from the American system of manufactures. Despite *The Engineer's* bluster, the combination of mechanisation and competition which relied on new ways of managing mechanisation began to force the pace of change.



Engineering recovered to some extent from the American machine tool invasion of the 1890s. But more important than the accelerating pace of mechanisation was the realisation of the implications for management. What we see in engineering therefore, growing out of the scientific-technical revolution, is the beginnings of a new division of mental/manual labour, and a managerial ideology to explain and justify it, which shares a common starting point with the ideas of scientific management as developed by Taylor.

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## Notes

<sup>1</sup> Information about scientific management in Europe is sketchy but it appears that Taylor's impact before 1914 was minimal, with the most significant developments taking place between the wars. British experience does not seem to be exceptional. For the Netherlands, John Armstrong's review (1990) of E. Bloemen, *Scientific Management in the Netherlands*; In Germany, Siemens adopted Taylorist principles after the first world war (Homberg 1983); for France, G. C. Humphreys (1986); In Italy, Taylorism spread after the war and became prevalent in the 1930s, Fiat adopted a Taylorist/Fordist strategy in the '20s, Alfa Romeo, in the 30s (Bigazzi 1986).

<sup>2</sup> According to Thoms and Donnelly (1985: 87), by the 1930s production methods at Morris were said to 'equal best American practice, with machinery following in line according to the nature of the work rather than being grouped in particular areas of the factory'.

<sup>3</sup> It is worth noting, however, that methods of organising work were not necessarily very different from what they might have been had efficiency engineers designed them. Castle (1986:152) notes that for the women at Courtauld 'the amount of work done each day was recorded on a card which hung above the machines ... The chargehand would check the cards every day and woe betide any girl who was 'down' on the amount of work produced or had too much waste'.

<sup>4</sup> The minutes of the Engineering Employers Federation in 1898 record a decision to purchase 1,500 copies of an article on piecework in *Cassiers* for distribution to members which



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could have been *Cassiers* reprint of Taylor's 'A Partial Solution to the Labour Problem', which appeared at about that time (EEF Minutes Feb. 1898; *Cassiers* vol. 13, 1898)

<sup>5</sup> Gilbreth wrote a furious reply (May 1917), arguing that 'our methods aim to increase interest in work as well as eliminate waste' and accusing *The Engineer* of being against training and progress. In reply, the editor simply noted that Mr. Gilbreth had enclosed a circular on simplified spelling!

## **Chapter 2 Scientific Management Practice to 1921**

Chapter 1 showed how British engineers identified Taylorism as an extension of the technical and managerial changes taking place in British industry. In this chapter I review the evidence for scientific management practice in the period from the turn of the century to the boom following the first world war and show that while there were few explicitly Taylorist experiments before 1914, there is evidence of changing management practice sufficient to prepare the ground for the conversion of the engineering establishment to scientific management during the first world war.

I also explore the relationship between Taylorism and premium bonus and discuss the effects of war-time dilution and the spread of systems of payment by results. I argue that although premium bonus could not be equated with scientific management, it came out of the same stable and in the hands of employers like Rowan was used in much the same way. The war popularised scientific management which reached a peak of influence during the short lived post-war boom. With the slump in 1921 attention shifted away from broad principles to discussion of specific practices such as the role of planning departments and of time study.

### **Scientific Management before the War**

There were early British theorists and managers who contributed, in more or less significant ways, to the development of modern management thought and practice. Garcke and Fells who published their *Factory Accounts* in 1887 and Slater Lewis, the general manager at a Salford Rolling Mill, who published *The Commercial Organisation of Factories* in 1896, are frequently cited (Urwick 1938:37; Horn



1983:9). There were others like Francis G. Burton, whose *Commercial Management of Engineering Works* (1898) discussed in detail the role of managers and accountants, systems for handling orders, invoices and estimating labour costs. But it remains true that there are no British theorists of scientific management to place alongside Taylor, Gilbreth or Gantt; no British showplace of scientific management in action like the Tabor Manufacturing Company, and no industry of efficiency engineers comparable to that which grew up in America. And this remains true even for the inter-war years despite the best efforts of manufacturers like Renold, or of the industrial psychologists from the National Institute of Industrial Psychology, or engineers from the Bedaux company.

On one view then there was little or no scientific management practice in Britain before the first world war. According to Henry Atkinson (1919), author of a lengthy series of articles explaining and advocating scientific management, only one firm in Britain had adopted the system prior to the war. And as late as 1917 *Engineering*, although now claiming that scientific management was 'merely a development of a British system' (Dec. 1917), could not give a detailed account of an application in any important establishment. Even Urwick writing in 1938 found it 'impossible to present any quantitative analysis of the degree to which modern methods of management have penetrated British business practice' (Urwick 1938:79).

However, judgements about the significance of scientific management before 1914 depend, to some extent, on whether a broader or a narrower view of scientific management is adopted<sup>1</sup>. The British efficiency engineer, Alexander Hamilton Church, who left Britain to practise in America, defined scientific management as the planning of industrial activity and the predetermination of standards of

efficiency. If Church was right, retorted an engineering critic, P Ballard, there was nothing new about scientific management and no need for its so-called body of principles. The modern tendency towards monopoly and the substitution of co-operation for competition led to 'the centralisation of management, and that because of this huge centralisation the discussion of "Scientific Management" springs into prominence' (1911). There is certainly more evidence of scientific management in Church's sense than examples of the direct application of Taylor's principles.

However, *Engineering* might have cited scientific management at Renold, for which Kreis (1990) has provided a detailed account for the period between 1910 and 1920. Systematic time study began with Allingham's appointment as 'production consultant' in 1911, and in the following year, a Production Study Department was established with Allingham now described as the Chief Production Engineer. By 1915 time study had been applied in nearly every department of the Manchester works, not only to find how long a job should take, but also to find the best methods of doing it (Kreis 1990:136). A complex bonus scheme and labour grading scheme was adopted with a steep rise in rewards as efficiency approached 100%, and an experiment conducted with functional foremanship before it was abandoned for a line and staff model.

Charles Renold's own account states that 'In 1912 methods of "Scientific Management" were introduced after an investigation in USA of the work of F. W. Taylor. By 1913 Organisation Charts were in full use, setting out the structure of the business and the delegation of authority' (Renold 1950:14). Interestingly enough though, Renold's account makes it clear that a number of key developments took place before 1912. By the end of 1909 a Central Office



established by Charles Renold, busily engaged in 'helping father', 'had become the nerve centre of the whole business' and the starting point of a longer term reorganisation of management, developing functional specialisation at a number of levels. Renold records that 'a movement which began with attention focused on speeding up individual workers ended with attention focused on management and the means of control, coupled with great attention to the relationship between management and workers. In our experience these latter developments far outweigh in their contribution to efficiency the original ones' (quoted in Kreis 1990:115).

Renold was exceptional. There does not appear to be any other account of self-consciously scientific management practice before the first world war, though in addition to Renold, Urwick (1938) cites as a 'complete application' the firm Taylor, Taylor and Hobson, lens and optical instrument makers from Leicester, where the Halsey premium system, job cards and time study was introduced after 1900. A number of others, including Dunlop Rubber, Arthur H. Lee and Sons, and Mavor and Coulson began a reorganisation before 1914 which was completed during or after the war.

Elsewhere the evidence is fragmentary, but there are traces of scientific management practice. At Hopkinson's Valve Works at Huddersfield in 1905, 'The card system is adopted throughout' and 'no instruction passes from the office to the foreman or the men without them'. Hopkinson's foundry, though not the main works, implemented the differential rate, described as a system 'introduced from the United States into several works in this country' (*Engineering* Sept. 1905). If Hopkinson was not typical neither was it an isolated example. A. P. Loscher told the Manchester Association of Engineers in 1901 that his firm used the card system

and the differential rate with rates fixed by 'scientific methods' (Loscher 1901). He expressed surprise that such methods were not more universally adopted in Britain and was told, by J. Collier, that modern methods were more widespread than the author seemed to think.

Elements of scientific management were also apparent in changing workshop and manufacturing practice more generally, from the team system of the Bristol boot and shoe industry (Hobsbawm 1976) to the more advanced engineering and motor companies making extensive use of jigs and producing interchangeable parts along repetition lines. At Daimler even the chassis for the king's car 'in no way strikingly differs from the rest of the chassis in the shop' (*University of Birmingham Engineering Journal* April 1903). It was implicit too in the subdivision of processes and use of automatic machinery, described by Edward Cadbury, which had almost eliminated any demand for initiative from workers (Cadbury 1912:20).

We know too that American influence was significant. Americans were willing teachers as well as competitors. 'The charming openness of American engineers - in affording every facility for competitors to go freely through their workshops' was frequently remarked on (Wood 1901). British engineers were not slow to take advantage of American hospitality. It was estimated that between 1,500 and 2,000 engineers from various institutes would visit America in 1904, a figure which took no account of those making individual arrangements (*Engineering* April 1904). Among the latter, before and after the first world war, were nearly all the leading employers including Austin, Morris and Herbert. Oliver Lucas' trips to America were found to be so profitable to the firm that they became an annual pilgrimage.



And if there was no systematic time study before the war, there were plenty of complaints about rate fixers and 'the method of speeding up by means of an army of non-productive officials' (*Engineering* Sept. 1912). Francis Burton had referred to piecework rates being fixed by the works manager 'or by a department under his immediate direction if the analytical piecework system is adopted' (1898). At Bournville, time study sought to establish the best methods to be chosen as standard 'with others taught to follow it' (Cadbury 1912:141). J. E. Prosser of the Works Organisation Department, and management representative on the piece rates and grading committee, would probably have distinguished piecework at Bournville from scientific management which he defined as a process which set the task for the worker to achieve as well as the time allowed on the job, but the distinction is hardly fundamental (Prosser 1919; Rowlinson 1988).

At G. and J. Weir, standardisation and the use of automatic machinery went together with time study and the use of the premium bonus scheme. Machinery was not grouped by type 'but rather into departments in which each distinctive part of a pump could be completed' (*Engineering* June 1901). McKinlay argues that management at Weir's was unsophisticated because the piecework system was administered by Weir together with five men and two boys (1986). But this does not seem particularly significant. Taylor himself had suggested that most places would only need one man for a rate-fixing department, and he would not need to give over his whole time to it (1895).

There were efficiency experts too. Allingham, Renold's Production Consultant, had conducted experiments at Brown and Sharpe Automatic Screw Machines in Manchester in 1913 (Allingham 1919). From Renold, Allingham moved to Armstrong Whitworth and such experts were quick to defend scientific



management from criticism in the pages of the technical press (*Engineering*, Aug. 1912, Sept. 1912, July 1913). New techniques in cost accounting were also being developed which moved away from simply recording production costs to analysing costs in the search for economies as part of the process of planning production (*Engineering* Feb. 1913). Standard costing 'developed as part of the 'scientific management' movement' (Parker 1969:22). If it had to wait until the 1920s to receive serious academic attention from the economists, and many engineers too, it nevertheless formed part of the discussion of workshop practice before the war.

Writing before the war as 'an old workman' about the 'madness' of a generalised demand for the eight hour day, T. Good acknowledged that hours of work were bound up with the question of speeding up: 'The old slack methods of workshop management, under which men could invariably take things easy before breakfast, and enjoyed frequent rest times between jobs without loss of pay, have been superseded by American methods of hustle' (1913). Two years into the war, Good again drew attention to speed-up from the turn of the century, to 'the new machines, new processes, and new methods of workshop management, which have resulted in the men having to work much harder' (1916). Workshops, he argued, had been Americanised in methods but not in pay.

### **Premium Bonus**

Into Americanised workshops, alongside the new tools and forms of management organisation, new payment systems were being introduced from the turn of the century. Most noticeable was the spread of piecework. The number of fitters and turners on piecework rose from around 6% in 1886 to 46% of fitters and 37% of turners before the outbreak of the first world war (Jefferys 1945:126). Piecework had been around for a long time - Marx called it the system 'most in harmony with



the capitalist mode of production' (1977:521) - but many of the new schemes took the form of premium bonus or efficiency systems, sometimes backed by more rigorous analysis of productive time, but in any case more often linked to new instructions from the office, more tightly defined tasks, and new forms of supervisory authority in the form of rate fixers, progress chasers and feed and speed men.

The two main forms of premium bonus system worked in Britain were those associated with David Rowan and G. and J. Weir Ltd. Weir's system was similar to that of Halsey and relatively straightforward. The worker was credited with half the time saved on a job (Halsey usually paid a third) in the form of a premium. For example, if a job was allocated 100 hours and completed in 50, the worker would be paid 75 hours at the agreed time rate. The Rowan system was more complicated. The worker received in bonus the same percentage of his hourly rate as the proportion of time saved. Ten percent time saved on a job was rewarded with a 10% increase in the hourly rate spent completing it, the bonus being arrived at by multiplying the time saved by time taken, divided by the time allowed. All such bonus schemes were regressive, that is to say, the worker's bonus earnings failed to rise in the same proportion as the increase in output, while unit labour costs fell for the employer. All were described as gain sharing plans, so called because the benefit of increased output was shared between worker and employer. The major difference between Weir and Rowan was the pattern of bonus earnings - the shape of the bonus curve - as worker output increased. With the Halsey/Weir scheme, bonus earnings rose more slowly to the point at which half the time allowed for the job was saved, but could continue to rise thereafter without limit. Rowan provided more rapid returns to the half way point but with sharply

diminishing returns thereafter and with something less than double earnings as a bonus ceiling (Cole 1918; *The Engineer* 1917).

The TUC enquiry in 1910 revealed that premium bonus chiefly affected the engineering and related trades, especially ordnance, motors, and locomotive and electrical engineering 'where repetition work is the rule' (*The Engineer* March 1910). At that time only a little over 9% of the ASE's membership were on premium bonus (McLaine 1944:634; Jefferys 1945:126; Littler 1982:85). EEF figures for men in engine shops in 1921, the last year for which numbers on premium bonus are cited separately from 'payment by results', suggest that a little under 7% of the workforce were on premium bonus (eef/237/13/3/4).

But these figures may seriously underestimate the extent of the system before the war. Detailed returns from 90% of the federated firms for 1914 show 18% of fitters and 16% of turners, 28% of grinders and 34% of millers, on premium bonus.



**Table 1            Premium Bonus in Engineering, 1914**

Trades                    Total    Time        Piece    Premium    %age    %age    %age  
                                  Work        Work        Bonus       Time       piece    premium

Miller	2798	889	957	952	32	34	34
Grinder	1688	698	520	479	41	31	28
Slotter	1840	850	539	451	46	29	25
Machine Men	7316	2150	3515	1651	29	48	23
Borer	2146	1244	492	410	58	23	19
Fitter	36117	21855	7785	6477	61	22	18
Turner	15863	8697	4588	2578	55	29	16
Labourer	23095	21856	804	433	95	3	2
Pattern M	4369	4164	87	118	95	2	3
Millwright	1352	1275	2	77	94	0	6
Smiths	3016	1927	855	234	65	28	8

All figures to the nearest whole number

Source: eef/237/13/3/3

**Premium Bonus and Taylorism**

But was premium bonus a form of scientific management? Cole (1918) distinguishes premium bonus from efficiency systems on the grounds that the former were not based on a scientific method of fixing prices. There is little doubt that premium bonus was adopted in Britain precisely because it was seen as a safeguard against inadequate rate-fixing standards. *The Engineer*, with characteristic conservatism, saw premium bonus as an opportunity to put the rate-

fixing department, 'the other dreaded accompaniment of the premium system', in its place (April 1902). And William Rowan Thompson, one of the leading advocates of premium bonus, told the Institute of Engineers and Shipbuilders in Scotland that the system of breaking jobs into elements for the purposes of fixing times was too elaborate, 'it is magnificent but it is not business' (eef/237/3/1/205).

But Taylor himself distinguished his system from the Towne-Halsey premium bonus plan on different grounds. In his system, time study was to be used to find a fair day's work for a first class man and a bonus system constructed to deliver it. Halsey's system might use time study but 'Under the Towne-Halsey plan the management gives up all direct effort to reach this quickest time, but offers mild inducements to the workmen to do so, and turns over the whole enterprise to them' (1947:59). Halsey was just as concerned to distinguish himself from Taylor and wrote to rebuke George Barnes of the ASE, and *The Engineer*, for describing the Taylor-Gantt system at Bethlehem Steel as a premium plan (*The Engineer* April 1902). But Halsey did not call time study into question. Moreover, Taylor seemed to think that 'It is task management which is in use in England, not the Towne-Halsey system...' And that people using the two systems were confused about them, 'This is practically true in England, where in some cases task management is actually being used under the name of the Premium Plan' (1947:43). Nor were the Federation of Engineering and Shipbuilding Trades in any doubt where premium bonus originated and denounced it as 'an adaptation of the most pernicious and degrading condition of employment in modern industrial history - the task work system' (eef/237/3/1/204).

The distinction between rate fixing as a loose form of estimating and time and motion study is important - time and motion study was the decisive innovation of



scientific management and one that linked new ways of managing labour to wider forms of production management. However, such categories should not be treated too rigidly. The distinctions in practice between rate fixing, systematic time study and modern work study are blurred at the edges as one merges into another.

Taylor's 'task management' is distinguished from Halsey's premium bonus by the rigour with which the 'task' is set and the way the task is rewarded, not by the idea of task management as such. Both premium bonus and Taylor's differential rate scheme set a task in the sense that each offered a given bonus reward for a defined level of performance. Indeed, so did many piecework schemes in which the pieceworker was expected to earn a third more than the time rate for a given output. Taylor demanded the achievement of his scientifically determined task before bonus was earned (the differential rate), but Gantt's task and bonus and Emerson's efficiency scheme, both of which must qualify as scientific task management, softened Taylor's formula by providing graded bonus returns as 'financial inducements' to meet the task. To this extent the distinction between Halsey and Taylor, where both use time study and are linked to the wider changes in technology and management taking place at the same time, is one of degree.

To argue as much is not to underestimate the importance of the difference between them. Kreis goes too far in arguing that 'premium bonus was merely another name for scientific management' (1990:95). Littler is surely right to emphasise that premium bonus represented only the beginnings of a shift to formal standards of effort, the beginnings of task measurement and the increased observability of work behaviour (1982:88). The problem with Littler's account is that it distinguishes premium bonus too sharply from scientific management because of the primitive nature of its time study procedures. Consequently Littler looks backwards to the break up of subcontracting to which premium bonus was not really connected at



all, and leaps forward from premium bonus to Bedaux between the wars, missing out important developments in time study linked to more traditional piecework schemes. Ironically, one American authority described Bedaux as 'a special application of the principle of the Halsey premium plan' because part of bonus earnings were distributed to supervision just as premium bonus earnings were shared with the employer (Diemar 1930:36).

If premium bonus and its rate-fixing procedures looked crude in comparison with what Taylor was doing, it was often distinctly advanced in comparison with past practice. Despite its compromised time-study standards, premium bonus was still widely associated with repetition work, was defended by employers who used it on much the same grounds as those who defended scientific management, and attracted the same sort of criticism that Taylorism did for being inapplicable to British conditions. It was a system from across the Atlantic and associated in people's minds with the flood of literature on 'the equipment and organisation of engineering works' (*The Engineer* Sept. 1901).

### **Work Standards and Time Study**

Premium bonus, like Taylor's plan, was designed to tackle what Taylor called soldiering and what was described in Britain as ca'canny, or deliberate restriction of output. A number of sources point to the paradox of increased intensity of work and falling labour productivity in the closing decades of the 19th century (Hobsbawm 1976; Stearns 1975; Brown 1977). Certainly this period saw a sustained campaign by employers against restriction of output and an ideological campaign against 'the lump of labour fallacy'. The problem with day work, wrote *Cassiers*, was that workers slowed down, 'In individual cases a marvellous facility is sometimes developed in keeping a job going for an extraordinary time' (1892 vol.



1). The way to raise wages, *Engineering* told the workers opposed to piecework, is to raise the efficiency of the labourer (Aug. 1891). If we could get as much work out of the worker as the Americans do, *The Engineer* declared in 1894, 'English employers might even accept the seven hour day with equanimity' (March 1894). And in the year that Alexander Hamilton Church called for 'a campaign to convert the British artisan to a proper appreciation of the true principles of progress' (1901), Edwin Pratt's series appeared in the *Times* attacking trade union restrictions on output for causing a crisis in British industry (Brown 1977:116).

The difference between premium bonus and Taylorism, as well as their common purpose in attempting to seize control of work standards, was neatly demonstrated by Carl Barth in his re-statement of Taylor's attack on the Halsey scheme. Comparing Halsey and Rowan on the one hand and Taylor and Gantt on the other, Barth argued that the worker would soon discover that the Rowan plan was designed as a means of making him 'disclose the real time required for the execution of a piece of work about which the management has shown its complete ignorance'. The different ways such schemes had of relating rewards to the accomplishment of the task were of secondary importance, 'The important matter is to abandon the old way of guessing at the time it takes to do a piece of work, and earnestly get to work to obtain scientific methods for the determination of the best time in which work can be done, and on the strength of this set ourselves and our employees a definite task to accomplish each day as so strenuously recommended by Mr Taylor' (Barth 1910). Barth underestimated the role of time study in premium systems but his characterisation of Rowan is interesting since, while time study is the supposedly scientific way to disclose the real time required for the execution of a piece of work, the ends are clearly identical. And it was precisely for this reason that workers resented the threat of premium bonus.



It explains why, for example, despite the fierce opposition to premium bonus there were also fears that once established the scheme might be abolished! The ASE had insisted in Clause 4 of the Carlisle memorandum that no firm should establish a premium bonus system without intending to adhere to it. The fear was that the system would be introduced to find out what workers could do and the firm would then revert to day work but demand the same performance level of its employees. The system, argued the ASE official James Ratcliffe in conference with Armstrong Whitworth, was only a way of seeing what a man could do under pressure, an accusation he repeated in conference with another North East Coast firm, Central Marine, in July 1902. In 1904 the ASE complained that the system had been abandoned at Kerr, Stewart and Co. at Stoke on Trent and that the company had reverted to piecework. The following year the ASE lodged a similar complaint against William Muir in Manchester (eef/237/3/1/204).

If employers wanted premium bonus to attack the output restriction of day work, they also offered the new system as a way of avoiding rate cutting. The problem of piecework, all agreed, was that as output rose, piecework prices were cut. At a time when changes in machinery, tools and methods made it even more difficult than usual to determine what constituted a fair day's work, premium bonus seemed to offer a way of establishing new standards of performance at minimum risk.

But if premium bonus compensated for rough and ready rate fixing it nevertheless entailed new attention to work standards and time study. In a series of articles on premium bonus and efficiency for the International Engineering Congress at Glasgow in 1901, the leading advocates of premium bonus stressed the importance of accurate data for time keeping and cost purposes generated by the system, the



links between premium bonus, standardisation and proper tooling, as well as making reference to the experience at Bethlehem Steel and Taylor's work (Rowan 1901; Thompson 1901; Weir and Richmond 1901). Rowan's paper on the premium system three years later advised employers to establish a separate rate-fixing department and not to rely on times already established or reported by the men. 'Data should be gathered systematically and with great care', Rowan argued, and a time established for each of the elements of the operation. Moreover, in an indication of quite advanced thinking on time study, he argued that the time should be fixed as if the work were being done on the best machine with all the appropriate equipment and with allowances being added to compensate for a lack of such standardisation (Rowan 1903). These were Taylor's ideas filtered through a particular British experience.

It is true that time study remained underdeveloped. As late as 1918 *Cassiers* was complaining that very few works made adequate provision for it (March 1918). But something approaching systematic time study was certainly carried on at companies like Renold and Cadbury; almost certainly too at A. P. Loscher's company, at Hopkinson's Valve where the differential rate was used, and at those companies where premium bonus approximated to the practice described by Rowan. At Central Marine on the North East Coast data had been gathered over a three year period to support it, more than a little excessive if they were simply based on existing practice (eef/237/3/1/204). The foreman based piecework prices or times on past practice and experience. Increasingly, rate fixers did not. The labour element in any job was problematic. But rate fixing was becoming more sophisticated on machine cycle times and these constituted an increasingly important element in the struggle over working time (Ragot 1908). Post-war discussion showed a shift away from premium bonus as confidence in accurate rate



fixing grew, and rate fixing was not a product of the war. It had been growing steadily throughout the period to 1914.

In the discussion of Rowan's paper, Professor Barr, of Barr and Stroud, attempted to play down the clerical costs of introducing premium bonus, a feature that attracted frequent criticism (*The Engineer* April 1903). But the burden of his argument was that the premium system 'brought management into touch with the methods of the workshop' which increased knowledge of costs and led to further changes in methods and design. Although William Rowan Thompson had described Taylor type time study as 'magnificent but not business', he favoured careful analysis and comparison of accumulated data in setting times and argued that 'by far the greatest benefit to the employer is one that has to be experienced to be realised, and that is the amazing defects and short comings hitherto unsuspected which it brings to light in the general Management and Organisation of an Establishment' (eef/237/3/1/205). In particular the job progress card, made out by the rate-fixing department, provided a great deal of useful management information. Premium bonus was not simply another form of piecework incentive. It was the product of changes in workshop organisation and tied in to wider managerial change.

### **Managerial Strategies and Worker Resistance**

The TUC protested that premium bonus undermined craftsmanship. Resistance was certainly strongest in the older, established engineering centres of the North and the system spread fastest among the newer machine shop trades like milling and grinding, and in the newer industrial centres. In 1913, less than 7% of the 7,000 fitters and turners on the North East Coast, where a considerable struggle had taken place, were on premium bonus compared with 43% in Coventry and London



(eef/237/13/3/4). But what was undermining the craftsman was the combination of processes which included premium bonus alongside the machine question, rate fixing, job cards with feed and speed instructions and so on. The employers themselves rarely brought all these things together in a concerted offensive, and workers responded to a fragmented agenda in a piecemeal fashion.

At the Elswick works of Armstrong Whitworth there were complaints that 'lads' were being set to work against the men to compare their speed with the journeymen, and that men who were unable to reduce bonus times were being discharged (eef/237/3/1/204). At the British United Shoe Machinery Co. in Leicester in 1914 there were complaints that premium bonus on capstan lathes was being worked at lower day rates, and of substitution of 'lower rated men for fully skilled men' (eef/237/3/1/205). But worker complaints about premium bonus were overwhelmingly about output targets which primarily concerned money and fears for employment. The response was largely a pragmatic one. 'At Barrow', reported Cole, 'the workman has usually been able to earn a good percentage on his day rate, because the time allowances give a good margin. This being so, he has not bothered his head, as a rule, about the fundamental justice or injustice of the system under which he is working' (1918:53). The fact is that it was extremely difficult for conventional forms of trade union organisation and bargaining to deal with the inter-relationships between different aspects of change. At Coventry Chain, Ryder, for the ASE, disputed the reduction of time allowances following the subdivision of jobs - the separation of roughing from finishing operations - on the view that the Carlisle Memorandum on premium bonus did not treat subdivision of labour as an improvement in methods of manufacture (eef/237/3/1/205). An inconclusive argument followed which Ryder could only try to resolve by asking for greater



consideration for the man doing the finishing operation. The treatment of subdivided labour was the issue, not the subdivision itself.

Management tactics in introducing premium bonus were often extremely crude. At Browetts in 1902 Barnes complained that 'there are several men, who at the end of the week found small sums of money in their boxes more than they expected, and when they asked what it meant were told that they were working under the Premium Bonus System'. The firm blamed the day man for failing to inform his mate on the nightshift! In the same year James Ratcliffe complained to the North East Coast Engineering employers that a number of firms were putting money into the men's boxes without telling them (eef/237/3/1/204). It all seems a far cry from a system that could provide an incentive to increase output. Cole suggests that this tactic of treating the bonus as an ex-gratia payment was designed to avoid any commitment to collective bargaining, and although partly rectified by the Carlisle agreement, complaints continued that not only did employees not understand the system, but that they were kept in the dark about time allowances on jobs and were unable to distinguish weekly pay from bonus earnings. In 1911 only half the firms making returns on the Tyne issued pay notes of any description to pieceworkers (eef/237/3/1/204).

The EEF certainly made a determined attempt to evade collective bargaining on the essentials of premium bonus. At Vickers in Barrow, in 1909, the ASE asked for details of the times set by the rate fixer and for details of the methods the rate fixer had used in arriving at them. The company replied that details of the job were already provided on the job card but 'they considered it impossible for workmen to become sufficiently expert to determine whether the time values were correct or not'. Vickers were worried that if the unions succeeded in their aim of



'standardising basis times', the job of the rate fixer would be made more difficult. The EEF agreed and wrote to the company telling them that 'If you agree to what the men now request you would very much affect the status of the Rate Fixing department and would probably increase your troubles instead of diminishing them' (eef/237/3/1/205). Similarly, in 1911 the EEF was resisting the establishment of shop committees in connection with premium bonus because 'no matter what their function might be originally, that function would soon extend to the negotiation and fixing of basis hours' (EEF Minutes Feb. 1911). Throughout the EEF maintained the position that mutual agreement could only apply between the employer and his workmen. It could not be a matter for the union.

This policy was clearly intended to confront the individual worker with the power of the employer and on countless unrecorded occasions the results must have been highly satisfactory for the latter. In a rare letter from a pieceworker to the engineering press in 1923, J. Taylor complained that only 10% of the men in any shop were on paying jobs. Working piecework was physically exhausting and led to selfish behaviour with tools being stolen or hidden. Pieceworkers were often laid off and men on day rates put on the job who were required to meet the same output (*The Engineer* Nov. 1923). However, the EEF's position could not prevent some form of bargaining taking place. A number of central conferences on premium bonus issues were held, particularly in the Barrow District (eef/237/3/1/205). At the Phoenix Dynamo Co. in Bradford, disputed job times could go to a joint union-management committee (Goodrich 1975:170). And at Vickers in 1918 an Appeals Section was established, with shop steward representation, to hear disputes over job times which dealt with 194 cases between January and September of 1918 (eef/237/3/1/206).



In fact, the attitude of the EEF may have encouraged the very thing employers feared most, that shop floor workers would react to unacceptable job times simply by slowing down. Rowan abandoned the practice of paying the premium in steps of 5% because the men had worked out whether or not they could make the next bonus payment and if they could not, made the job last (Rowan 1903). As premium bonus spread during the war, so did criticism that its regressive feature, far from safeguarding the employer, only led to renewed restriction of output. A correspondent pointed out to *The Engineer* in 1917 that the system 'was not as perfect as you would have us believe'. The return to the worker fell after saving 50% of the time but 'if the men are awake, they take care not to reach this point. They figure it all out to a half penny' (Jan. 1917).

Workers could not defeat premium bonus but they could secure better times, fight for more generous allowances, appeal to the foreman against the rate fixer, and if necessary, spin a job out until something better came along. In 1900 the EEF requested the Executive Council of the ASE to ensure that the local opposition to piecework at Thwaites in Bradford would be dropped. It was a request which had to be repeated in 1902 and it wasn't until March 1903 that the EEF reported that Thwaites had established piecework 'on their own lines' (EEF Minutes March 1903). The struggle over premium bonus before the first world war, and over Bedaux between the wars, was a struggle on the one side against degrading systems of employment - systems which were justified from the other side as the means to secure lasting class co-operation through increased prosperity. But most of the time such perspectives, and the class antagonisms which lay behind them, were only hazily grasped. From day to day, the struggle for authority and control within the labour process was conducted, in Price's words, 'in the continual search from both sides for a better bargain' (1983:62).



## **The Impact of War**

The war is often seen as a turning point, a decisive break in the development of production methods and management, driven by the needs of the munitions industry and dilution of labour (Burgess 1980:166; Pollard 1983:53). There is some truth in this but matters were not quite so simple. The war created an artificial mass market for goods and pressure for repetition methods which legitimised scientific management. In that sense the war settled many of the uncertainties and hesitations of the pre-war period. But it also exposed the conservatism of British employers, and with the passing of the artificial conditions created by war, British business reverted to a slower path of development along lines already apparent before 1914<sup>2</sup>.

The state played a central role as catalyst in war-time business and management change through the dilution programme, the spread of premium bonus and the establishment of the Industrial Fatigue Research Board, as well as the activities of the Reconstruction Council. Surprisingly, Lewchuk (1984) finds otherwise. Indeed, he argues that 'state intervention during the war moved the British economy away from the unilateral management control strategy of Fordism and scientific management'. Reid (1985) too argues that government appeased labour, and that government departments were divided over dilution and at odds with conservative employers resisting the rationalisation of labour. But Lewchuk's argument depends on the misconception that Fordism and Taylorism required unilateral control when scientific managers in America and Britain quickly oriented themselves to winning trade union support whatever Taylor's early prejudices (Nadworny 1955; Atkinson 1919). And while Reid rightly draws attention to employer conservatism and Admiralty manoeuvres designed to retain skilled labour

in the shipyards, the state forced the pace on dilution as long as the production of munitions demanded it.

The focus of much of war-time production management discussion, and the single most dramatic change in the workshops, centred on the employment of women.

The pre-war machine question which so agitated industrial relations in engineering, and which rumbled on throughout the inter-war years, disappears completely during the war to be replaced by struggles over the dilution of labour. The two issues are intimately related but they can be distinguished. The threat of mechanisation to the skilled worker lay in breaking the job down into simpler elements to be allocated to cheaper, semi-skilled labour. But particular struggles over new machinery did not always present this issue so bluntly. It might only mean a question of who would operate the new machinery to do much the same work, or to work on processes altered in relatively minor ways. Dilution using female labour was an extension of the processes of specialisation and mechanisation but involved immediate job fragmentation and new work processes, together with associated changes in training, supervision and management. At the same time dilution implied certain limits, most obviously in the temporary circumstances created by war, but also in deeply rooted prejudices against the employment of women on 'men's work'. In other words, dilution exposed the fragile claims of craft and confirmed the potential of new production methods but in circumstances where neither the threat nor the promise could be realised in full.

Before the war ended more than three quarters of a million women were employed in the engineering industry and allied metal trades, including a variety of machine processes such as drilling, tapping, milling, slotting, boring and shaping (Rowe 1928:147; Ministry of Munitions 1917:19). *The Engineer* found the effect of



women in the workshops 'astonishing', and not only when employed on repetition work. They had shown themselves capable of performing operations hitherto 'carried out exclusively by men' (Aug. 1915). *Engineering* was similarly impressed, commenting that 'The ability of women to do work that was previously exclusively done by men has been one of the outstanding revelations of the war' (June 1917).

In fact, women did not so much do the work that skilled men had previously done as parts of it. As the Ministry of Munitions pointed out, 'Where the work is skilled, the operations are usually subdivided, and the women do the simplest work, and always under the supervision of skilled men ... In this sense, the processes done by women are dissimilar to those done by skilled men' (1917:19). There were, of course, examples which could be cited of women on fully skilled work, and where semi-skilled processes were involved, the employment of women might lead to little change. But if women rarely replaced skilled men directly, the dilution commissioners were quick to point out that the 'war experience with women in engineering works has entirely destroyed all preconceived ideas as to what constituted "skilled work"' (Morgan 1918).

And the revelation of what women could do was quickly connected to Taylorism. The training programme of the Ministry of Munitions, argued *Engineering*, was 'only carrying further the principle of specialisation, which is the prominent feature in all modern manufacturing operations. For a long time the sphere of each man's work has been steadily narrowing and the calls on his resource and originality dwindling until, under the Taylor system, the man becomes an automaton, who gets through a prescribed cycle in so many seconds and then begins afresh. The manufacture of munitions lends itself admirably to such a system ...' (June 1916).

But despite claims by industrialists like Sir William Beardmore that women workers 'in all cases produced more than double that by thoroughly trained mechanics - members of the trade unions - working the same machines under the same conditions' (Beardmore 1916), women left, or were expelled from the workshops in large numbers at the end of the war. By 1921 the number of females engaged in the manufacture of metals, machines, implements and conveyances had fallen to 221,000 (Rowe 1928:157). Across the economy as a whole the story was broadly the same. The proportion of gainfully employed females stood at 30.8% in 1911, and 32.3% in 1921 (Roberts 1988:68).

### **Employer Conservatism**

The restoration of pre-war practices owed less to trade union demands or to Government honouring war-time promises than employer conservatism and the changed economic conditions of peace. It could be difficult to persuade trade unionists to accept dilution, wrote a Ministry official, Ben Morgan, but 'the employer often met dilution proposals with a blank incredulity which was beyond the influence or reach of reason' (1918:531). The Ministry continually complained of employer obstruction (mun5/70/324/20). 'Trade union prejudices have undoubtedly been a lion in the path', commented one dilution commissioner, but 'Bad works management in the hands of men to whom the production idea was totally unfamiliar has been another more serious difficulty' (Waites 1978:17). There seems to have been three main sources of employer opposition: prejudice of one kind or another against the employment of women, an unwillingness to bear the increased overhead costs associated with their employment, and an inability to see the possibilities inherent in dilution or manage its introduction.



Officials of the Ministry of Munitions worked to persuade employers of the value of dilution and to overcome the violent prejudice against women in the workshop (Ballie 1917)<sup>3</sup>. Sometimes that prejudice could take a simple and direct form. Charles Wickstead from Kettering claimed that women were not so truthful, honest, or reliable as men (*The Engineer* March 1918). Sir Alfred Herbert told the war cabinet that if women were cheap enough they could relieve the male worker from the drudgery of routine, but 'owing to certain fundamental differences in mentality it is perfectly certain that, save in the most exceptional circumstances, women cannot become skilled mechanics' (1919a). The mirror image of such prejudice was the elevation of women to a status beyond the realm of work. The first paper ever written (and read) by a woman to the Institute of Mechanical Engineers, on the employment of women in munitions factories, was careful to warn against acquiring increased economic efficiency at the cost of physical and spiritual welfare because it was 'the sacred duty of the state to ensure that women are only used as wealth producers in so far as it does not affect the healthy development of the race' (Monkhouse 1918).

It is unlikely that Midland employers with a significant female workforce between the wars, or employers in the new light engineering industries in which women played a central role, spent too much time making such a calculation. But ideas about the proper place of women will have played a part - certainly in the common practice of dismissing women workers who married and in reserving certain occupations for men.

### **The Production Idea**

There were also increased costs associated with the employment of women and employer fears of the loss of skilled men at a time of skill shortage. Women

supervisors were appointed to report to the foreman, setters employed to set up machines, and inspectors or 'viewers' appointed to check the work. Austin accounted for the reluctance of employers to employ women because of the expense of 'installing them', the added costs of changes in product design including the necessary jigs and fixtures and complaints about quality from some Government departments 'who had no sympathy whatever with dilution' (*Engineering* May 1918). But of course, most of these considerations applied equally to the employment of semi-skilled male workers and had more to do with what the dilution commissioners called familiarity with the 'production idea' than the employment of women.

By 1919 single purpose machine tools produced for war-time purposes were only fetching scrap prices as older patterns of demand were re-established. Women were advised that they could hardly complain if they were forced out of work. Returning soldiers had to have jobs and employers, once forced reluctantly down the path of dilution, were now free to choose in matters of works organisation 'and it is only commercial common sense to expect them to re-organise on the basis of adapting to ordinary trading conditions the best that was developed under the artificial conditions which have just come to an end' (*Machinery* June 1919; Feb. 1919).

But if the war failed to permanently transform production organisation and methods, those methods were subject to a new level of critical scrutiny and challenge. In his inaugural address as President of the Institute of Mechanical Engineers in 1917, Michael Longridge contrasted rule of thumb processes with the new approach of scientific management:



There are still shops without definite planning of the progress of the work, without adequate equipment of the jigs and gauges, and without standard shapes of tools or a tool room; where men drift about in search of tools and tackle, or wait in idleness for drawings or materials; where machinery is obsolete and light so bad that good work could not be done if the machinery were up to date. They cannot compete in price or quality of work with those in which what is known as "scientific management", or anything approaching it prevails .... (1917:436).

Despite employer resistance to dilution there were more and more workshops in which 'something approaching' scientific management did prevail. Major C. W. Thomas described the application of scientific management in a firebrick works (1917:542); a paper on works organisation at Parsons described how specification sheets issued by the drawing office passed through the production department before going to the shops (Parsons 1916:177); Rankin described the application of Emerson's payment system at his works (Rankin 1916); at the Lanchester works one of the Progress Department's jobs was to 'father' new parts through the works (*The Engineer* Feb. 1918) and an article by a senior progress section leader declared, perhaps over optimistically, that 'Every engineering firm at the present time has progress men, except in name, each of whom controls one or more of the duties that are assigned, under up-to-date systems, to the Progress Department' (*The Engineer* Dec. 1918). Responses to a paper on scientific management by James Richardson for the Institution of Engineers and Shipbuilders in 1918 told a similar story. Mr James Andrews declared that scientific management might be new in name but was already practised in marine engineering. Mr John Holloway of North British Diesel conceded that scientific management had been neglected for

too long, but not everywhere; that would be 'a libel on many firms and managers'. At North British Diesel there was a planning department which issued progress sheets, and 'where it was intended to utilise unskilled labour the work was divided into unskilled jigging operations, and in that way many components which had to be machined to close limits could be successfully carried out by unskilled workers' (*Cassiers* 1918a).

More generally, the war completed the conversion of a substantial part of the engineering establishment to scientific management<sup>4</sup>. A large section of British industry, argued *Cassiers* at the end of 1917, had learned the economic advantages of large output, continuous demand, standardisation and long production runs, automatic machinery, specialisation among workers and of 'universalising piecework speed' (*Cassiers Engineering Monthly* Dec. 1917). And in May 1917, W. L. Hitchens, Chair of Cammell Laird, told the National Economy Exhibition that 'Most people nowadays are familiar with the principles of scientific management so ably worked out by Mr Frederick Winslow Taylor and Mr F. B. Gilbreth' (*Engineering* May 1917).

### **Payment by Results During the War**

Payment by results, and premium bonus in particular, spread more rapidly during the war. Although the Ministry of Munitions put no figures on it the Ministry's analysis of wage systems in operation between 1915 and 1918 found that premium bonus had been 'widely extended', and that 'notwithstanding the conservative tendency of many employers and the hostility of many labour organisations, this method of remuneration has made conspicuous progress' (Mun/5/82/342/20). One reason it did so was the determination of the state to press for payment by results. The Committee on Production invariably backed one such system or another in the



cases which came before it, one reason why the unions refused an invitation in Jan. 1917 to participate in a joint enquiry into 'the most efficient and satisfactory system of payment by results'. In March 1917, the government pressed ahead with its own proposals and announced that 'it is in the National Interest that a system of payment by results should be established'. Employers were required to come up with proposals and unions to respond. Failure to make progress was to be referred to an Arbitration Tribunal (Mun5/83/342/120).

As with the period to the outbreak of war there is little evidence of payment systems being used directly to reconstruct the labour process along new lines determined by management. The massive switch to war work involving repetition methods and dilution was the principal focus of changing patterns of work. The question that dominated war-time payment by results was the familiar one of output standards and money, but with a war-time twist. 'The truth was that when almost every engineering shop in the country began to organise itself as an arsenal, it was very difficult for the management to estimate the wisest rates of pay for new work. They had little or no experience on which to proceed' (Mun/5/82/342/20). In some cases output was increased by three or four times or even more. At Thomeycrofts in Basingstoke, output of back axle castings for lorries increased six fold and management responded, as they did elsewhere, by introducing trivial changes in methods to justify cuts in piecework prices (eef/237/3/1/206). The earnings of semi-skilled workers outstripped those of skilled men. At G. and J. Weir there was trouble when skilled men were transferred from repetition work to skilled work and were confronted with a cut in earnings from around £8-£10 to £2 2s 9d a week (Mun/5/82/342/20). In other cases, semi-skilled men on piecework refused to be upgraded to tool setters for the same reason.



There were cases though when the implementation of a new system of payment by results, particularly where systematic time study was used, involved a more deliberate attempt to re-model the work process. An unusually detailed and frank example of this was described by R. Rankin to the Junior Institution of Engineers in 1916 (1916:337). The payment system was one designed by Harrington Emerson, with bonus calculations made on time taken rather than time saved. The bonus rate was one hour's pay and bonus rose from nil to 20% of the bonus rate when the job was completed in the time allowed and remained at that rate whatever further reduction in time taken was achieved. The men weren't supposed to understand it. In Rankin's opinion 'the system was far more successful in operation than any system would have been which they could have understood thoroughly'. Stop-watch studies were carried out 'as in Taylor's system of scientific management but without excessive attention being paid to small details on account of the urgency of the matter'. Operations were analysed to see if they took too long, if they were unnecessary, or to see if they 'could be done by boys or unskilled labour'. In so doing, Rankin encountered resistance from the foreman and the unions.

In one example cited a job was broken down into skilled and unskilled elements with the latter allocated to boys. The number of pieces per hour increased from 2.37 to between 11 and 12, with labour costs falling by 63%. In a second case, after much obstruction, it was found that 'one skilled man could keep two labourers going' and the foreman was instructed to try this method out. But the foreman was a trade unionist and arranged with the skilled men to do the labourer's work himself. Between them they slowed the job down considerably. According to Rankin, all this was observed without comment by the employer, 'the men deceived no one but themselves'. A second experiment was set up. This time, to 'avoid questions of trade union etiquette', the job was rearranged so that one labourer



kept two skilled men going. This attempt was also sabotaged by the foreman but semi-skilled men were put on the job anyway and Rankin claimed labour costs fell by 66%.

In a third department more serious resistance was encountered. With subdivision of labour and the employment of semi-skilled men, Rankin proposed to increase output from 6.5 to 30 pieces an hour. On the first day, a squad turned out 29 per hour but then refused to work the system and threatened to strike. A compromise was agreed and the struggle moved to a fourth department. Here the men responded to changes in work organisation with a demand for an increase in pay and went on strike to secure it. The workers contacted the London dailies and reports appeared under the headline 'Speeding Up Strike'. The men claimed they had already accepted speeding up to meet the national emergency and proposed arbitration, something Rankin described as a 'patriotic exaggeration' but 'rather a shrewd move on the part of the men'. Even following agreement to return and work the system, resistance continued. On the night shift there was a pacemaker who 'struck a bad patch' and reduced performance across the whole shift. Eventually however, output rose to more than fifty pieces an hour. Attention now reverted to department three and this time a strike was accepted and defeated with the men dismissed.

There are several points of interest in Rankin's account, not least the collaboration of foremen with trade unionists to frustrate management designs. Such collaboration may have been unusual but obstruction and lack of co-operation by foremen, whose own position was being undermined by changes in the structure of management control, was not. The processes which Rankin describes, of separating skilled from unskilled elements and redistributing the work among a mix of skilled



and unskilled workers, establishing new output standards for work reorganised in this way, backed by new piecework rewards, are all processes clearly at work in engineering from the turn of the century. Premium bonus, the machine question, rate fixers and other new managers, all the elements of what has been called 'workshop reorganisation', intensified these processes significantly. But where these elements were combined haphazardly, as was most often the case, change was partial, uneven and slow. Rankin described a management offensive in the Taylor tradition which brought all these elements together to confront labour, and some managers, with a new model. The self conscious, deliberate plan of reorganisation of the labour process distinguished Rankin from his contemporaries, but the elements that constituted that reorganisation were common enough.

The experience of bonus schemes under war-time conditions underlined the importance of time study. The Ministry of Labour observed that whatever payment system was under consideration, rate fixing was crucial, 'No system of payment by results can ever get rid of this difficulty. Different systems merely change the conditions under which it has to be treated' (Mun/5/82/342/20). And for this reason premium bonus schemes were attracting increasing criticism. 'Hopes of solving the rate fixing difficulty by means of the Rowan premium bonus system have long been disappointed', argued the Ministry, 'since workers had no difficulty in appreciating its "inner meaning"'. 'The workers are safeguarded against an occasional abuse by an arrangement under which the employer systematically shares in the time saved by the workers, that is, in the reward for special effort and increased production'. Nonetheless, premium bonus remained popular during the war. So much so that *The Engineer* reprinted its series of articles from 1902 as a book in 1917. But even *The Engineer* had difficulty defending its favourite system. A series of letters from W. J. T. in 1917 argued that once the employer had set up the works and



established a time for the job, the worker should receive all the gain from increased output due to his efforts. Any further improvements introduced by the employer could lead to revised job times but there was no justification for 'gain sharing'. *The Engineer* was reduced to pleading the need for falling labour costs to meet foreign competition (Feb. 1917).

Fears that workers who had appreciated the inner meaning of the system would retaliate with output restriction grew at the end of the war. There was renewed interest in piecework but backed by time study (Ramsey 1918). In 1918 the EEF established a sub-committee to investigate the basis on which payment by results systems could be constructed and 'The best methods of securing the data necessary to enable employers to fix correct prices and basis times' (eef/237/1/1/14). The following year, responding to the unions' claim for a 47 hour week, the EEF told the unions that production methods would have to change, 'We will have to standardise, we will have to go in for repetition work and adjust the products and the machinery and the men and the work in such as will give bulk production, whereas formerly we had special production which may or may not have been economical' (EEF Minutes May 1919). In focusing on payment systems, time study and 'bulk production', the engineering employers reflected a new post-war interest in scientific management, though one which was relatively short lived.

### **Scientific Management After the War**

By the end of the war a distinct shift in mood with regard to scientific management is evident. Scott Maxwell, addressing the Institution of Electrical Engineers on scientific management in 1919, noted with surprise the extent of interest in the technical press and the lack of antagonism. So too did *Cassiers* which recorded with obvious delight what it described as an 'official endorsement' of scientific

management in the report of the Committee on New Industries calling for the education of employers and their staff on what is being done in up-to-date works 'where quantity production under scientific management is carried on'. And in May *Cassiers Engineering and Industrial Management* was 'pleased to note a change in the attitude of many engineering journals on the question of efficiency of the management of works' (May 1919).

The flurry of post-war activity and discussion around the question of scientific management included the efforts to promote it by the Reconstruction Council in a series of lectures during 1919 which led to the formation of a sub-committee to carry on the propaganda work. In the same year James Butterworth addressed managers at the Royal Arsenal at Woolwich on scientific management, incentives and motion study; A. D. Denning, works secretary of Lotus Ltd and Edward Bostock and Co., delivered a series of lectures on scientific management for the Birmingham section of the Institute of Metals; and a series of articles by the Employment Manager of Turner Newall provided scientific management with a human relations gloss<sup>5</sup>.

In part a heightened interest in scientific management stemmed from fears about post-war labour unrest. 'The minds of the workers', wrote *Cassiers*, 'are saturated with the ridiculous and repulsive idea of the "class war" and the public ignorance of economics and history is generally favourable to the acceptance of the obsolete and unscientific doctrines of the German Karl Marx'. Educational work was needed to convince workers 'to accept the planning room's methods and programme, and to follow the system outlined by the experts in charge of the work' (*Cassiers Engineering and Industrial Management* March 1919). Scott Maxwell (1919) also advocated scientific management as an alternative to socialism. And in 1919



James Whitworth told the Reconstruction Council that the harmony and increased production created by scientific management obviated any need for a struggle between capital and labour over the surplus (1919).

Intense interest did not mean, however, that the pace of change on the ground had changed very much. *Cassiers* probably got it about right when it endorsed an article on scientific management which expressed 'the accepted opinion that while many establishments can lay no claim to any comprehensive scheme of organisation, the methods in practice contain within them elements of successful management' (June 1921)<sup>6</sup>. In 1919 Henry Chellew, LSE lecturer and adviser to the Federation of British Industries on efficiency methods, had announced the formation of the Society of Industrial and Efficiency Engineers. Nothing more was heard of it. British employers were not yet ready for any 'comprehensive scheme of organisation' but many of the elements of scientific management had become the common property of management as such. Paradoxically enough, the post-war years not only marked the height of interest in Britain in scientific management but the end of the debate about Taylorism and scientific management as a 'system'.

In 1920 R. H. Tawney pleaded for time and motion study to be applied to 'the immense mass of literature which is being turned out on "Scientific Management" in order to eliminate useless words, sentences and pages' (*Business Organisation and Management* March 1920). By 1921 he must have been a good deal happier as the flood of literature began to dry up. Ten years later a Board of Trade official charged with investigating the position wrote that 'although the library got a good deal on scientific management between 1919 and 1921, we have got hardly anything since' (BT56/44/CIA/1884/7). Talk of scientific management faded. A paper to the Institute of Production Engineers in 1923 spoke of the 'much used and



now much hated expression, "Scientific management" (*Machinery* Dec. 1923). No American, the Institute was told, now uses the phrase. Horn records the testimony of an engineer in the late 1920s who thought that 'The mere mention of Scientific Management today in an Engineering Works is sufficient to destroy a man's chances if he is after a management job' (1983:3).

However, the drying up of the great debate about scientific management that had begun in the years before the war did not necessarily mean that scientific management practice was no longer of any interest. For example, the manager of Metropolitan Vickers River Don works was scathing about the experts: 'Some of them as we know, could run the British Empire with a card index and could perform miracles of production by introducing their post-war systems into pre-war factories' (*Engineering Review and Trader* 1923). But he was describing, among other things, the operation of technical and mechanical processes and rate-fixing departments at his own works with the strong implication that his was an example of sensible and digestible scientific management as opposed to the over elaborate schemes of self proclaimed experts.

Two quite different things were happening as the post-war boom collapsed. First, there was a hardening of class attitudes among employers. The attack on wages took precedence over more sophisticated ways of reducing costs and increasing productivity, as employers turned inwards. The development of the personnel function via welfare work during the war was slowed or halted too. The great increase in power enjoyed by the employers diminished their interest in scientific solutions to a labour problem for which employer authority seemed a satisfactory answer. It is important to add the qualification however, that even in the depths of the slump, there were limits to what employers were able to do. There were also



limits to what they wanted to do, evidence of a certain 'constitutionalism', or at least a reluctance to engage in a frontal assault on positions however weakly defended.

Secondly, the focus of concern and discussion was shifting anyway, away from the pre-war themes of mechanisation and division of labour, and scientific management as a system, to discussion in detail of management organisation, and in particular, of the role of planning and progress departments. However inadequately there is a sense in which the earlier questions had been settled. Elements of scientific management had been largely absorbed as part of a larger development of management. 'Comparatively little is heard about scientific management now,' reported *Machinery* in 1925, 'and it might be inferred by those who are not closely in touch with manufacturing practice that the new plan has been discarded. While it is true that the rather elaborate expression "scientific management" is not used as often as it was, it is important to note that the fundamental principle remains and has proved its worth'. Costly implementations had been cut back and people had learned from this experience but 'the fundamental principles laid down by Mr Taylor and other pioneers will continue to be applied' (Dec. 1925).

Much the same point was made in America<sup>7</sup>. Dexter Kimball, in response to a suggestion from the secretary to the Industrial Fatigue Research Board in Britain that Taylorism was only practised in four or five American firms, argued that in America too, Taylorism had been absorbed. 'Few, if any enterprises will be found today that are organised exactly after the model set up by him at Bethlehem. But combinations of his methods in endless variety are to be found all over this country...Perhaps the most common elements to be found are those of rate setting

on the basis of accurate time study, and the planning and dispatching of operations on the basis of a prearranged time schedule' (Kimball 1927:593).

## **Conclusion**

In this chapter I have argued that elements of scientific management were evident in Britain before the first world war. Premium bonus fell some way short of Taylor's own prescriptions, but it could be used to define new work standards and tighten time study procedures as well as compensate for inadequate rate fixing.

The war gave a sharp stimulus to the interest in, and the practice of, scientific management, but its long term effect was to accelerate developments already underway and to complete the process by which Taylorism became accepted rather than mark any fundamental break in development. We should therefore see the war and the post-war discussion of scientific management, as bringing to a close the period which began in the 1890s. Scientific management was no longer a novelty and its principle propositions no longer seriously disputed. Employer conservatism continued to be an obstacle to the spread of scientific management practice but management was changing all the same.

In Chapter 3 I will examine changes in the structure of management and the development of new forms of production control from the turn of the century, and the extent to which this influenced management practice between the wars.



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## Notes

<sup>1</sup> Haydu suggests that scientific management existed more in theory than practice in the United States before 1914, with employers picking what suited them from among its techniques and that 'With the same provisos scientific management appeared in British engineering well before World War 1' (1988:38)

<sup>2</sup> Hyman believes it is arguable 'that the war did not accelerate but delayed these changes in the deployment of engineering labour which were apparent long before 1914' (1971:85)

<sup>3</sup> Austin told a gathering of boys at Bromsgrove High School in 1939 that he did not believe factory employment did girls any real good. Although he thought them a better proposition than men for monotonous work, he remained of the view that their employment was not 'right from a human point of view' (Lambert and Wyatt 1968)

<sup>4</sup> Longridge was congratulated by *Machinery* for his 'admirable summary of the aims of scientific management' (May 1917). Chapter 1 gave further details of debates about Taylorism in the engineering press.

<sup>5</sup> All were reported in *Cassiers Engineering and Industrial Management* for 1919; see also A. D. Denning's book, *Scientific Factory Management*, published in 1919. Denning reflects the consistent concerns of British advocates of scientific management with the importance of planning.

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<sup>6</sup> There were contrasts too. An American observer, Dwight T. Farnham, remarked on older plants where 'machines are big and slow and the work is done with due regard for precedent and the rights bestowed by Magna Carta'. At the same time there were in England, 'certain pioneers who have consciously installed scientific management and whose plants are marvels of efficiency, which equal, if they do not exceed, anything which has been developed elsewhere' (1921:168, 257).

<sup>7</sup> In 1947, A.S. Person, described by Daniel Nelson as the foremost authority on scientific management after Taylor, wrote that scarcely an American enterprise remained untouched by scientific management, 'Yet there are few individual examples of comprehensive, integrated scientific management' (1947:893).



## **Chapter 3      Management**

### **Introduction**

In this chapter I will trace the development of new management functions and their effects on older management structures including the position of the engineer and the foreman, and assess the evidence for the influence of scientific management on inter-war managerial practice. I will show that the development of production engineering and the eclipse of the foreman were indications of the spread of scientific management, a process which was not dependent on any particular Taylorist system such as Bedaux. It was however, a process which was uneven and incomplete, and this is brought out by examining the experience of a number of companies including Alfred Herbert and ICI's Metals Group

I will also discuss the relationship between scientific management, labour management and industrial psychology and outline British participation in the international scientific management movement. I will argue that the critics of Taylorism among industrial psychologists offered a complementary rather than a competing management philosophy and show that the origins of British Institution of Management lay in the scientific management movement of the 1930s.

### **Management Functions - The Growth of Office Services**

H. W. Allingham, discussing his experiences as a production consultant at Brown and Sharp in 1919, offered this definition of scientific management, '...it is really the recognition that such things can be worked out along regular lines, brought to a fine art and controlled by a series of office services, which differentiates modern factory methods, generally described as "scientific management"' (Allingham 1919)<sup>1</sup>. Such office services were developing from the turn of the century as the

drawing office took on wider production functions linked to design work and engineers were obliged to consider commercial as well as technical questions. Parallel, associated developments on the shop floor, saw the separation of the toolroom as a specialised department, the appearance of new management functionaries like the progress chasers, feed and speed men and rate fixers, and the transformation of the foreman from an organiser and planner of production to an executive for decisions made elsewhere.

Some part of this change is reflected in the changing function and status of the engineer. McGuffie's important book on management and labour in the European and American metal industries argues that the period 1890-1914 saw a dual process at work involving the specialisation and dequalification of labour on the one hand and the hyper qualification and professionalisation of the labour of superintendence and management on the other. The emergence of engineering as a profession is traced in the growth of the Institution of Mechanical Engineers and in the development of professional training which sought to commit employers and the state to recruiting a managerial cadre via extra-factory appointments from the school, college and university. 'From a managerial point of view', McGuffie argues, 'engineering had become a "profession" by 1913' (1985:105,114).

The difficulty is that if engineering had become a profession by 1913, it was, from a managerial point of view, still a relatively underdeveloped one. Premium apprenticeships on which management training continued to rely before the war (McGuffie 1985:114; Pollard 1989:200) was a system in terminal decline<sup>2</sup>. It taught pupils 'little or nothing' and was, according to Professor Kapp of Birmingham University, 'something brought down to us from the good old times when technical instruction could be acquired in no other way' (*Engineering* Sept.



1903; Kapp 1908). Engineers with college training were growing in number however, and by 1914 the combination of college and work based training had led 'to the emergence of a systematic theoretically based pattern of engineering education' (Buchanan 1989:175). Even so, it was not until 1924 that industrial economics was included in the examination syllabus for associate membership of the Institution of Mechanical Engineers, lending some support to Locke's criticism of the inadequacy of the engineering curriculum (*Engineering* Feb. 1924; Locke 1984). However, the managerial functions of the engineer were becoming more important and by 1924, half the college trained engineers could expect eventually to be employed on 'administrative work' (*Engineering* March 1924).

In broad terms the development of management functions is indicated by the proportion of administrative, technical and clerical staff which grew from 8% of the workforce in 1907, to 15% in the mid 1930s and 20% in 1948. In America, such grades constituted just under 12% as early as 1909 and 20% by 1939 (Gospel 1992:48; Florence 1965:139). In mining and manufacturing, the numbers of managers and administrators grew by 130% between 1921 and 1951 (Routh 1965: 22, 23)<sup>3</sup>. And membership of professional institutions for engineers, many of whom will have exercised management functions, grew rapidly even before the first world war (McGuffie 1985:111; Buchanan 1989:107)<sup>4</sup>.

It is harder to trace the growth in numbers of those engaged in other engineering management functions like progress chasing or rate fixing. Although British professionals seemed to have an Institution for just about everything, there was no organisation to represent those engaged in activities associated with rate fixing or time and motion study until three bodies were formed in the closing years of the second world war. Time and motion study was an important consideration for the



Institution of Production Engineers, but it is a comment on the slow development of work study in Britain that a viable organisation took so long to establish.

Yet there seemed to be no shortage of new personnel. In 1924 a foreman in Leicester complained that his department 'was overrun with progress chasers, cost clerks and other minor officials in search of information' (*Cassiers* March 1924). A faint reflection of the growth in their numbers may be traced in the membership of the Foreman's Mutual Benefit Society, established by the Engineering Employers Federation after the 1897 lock out with the aim of ensuring the loyalty of foremen. There were no rate fixers recorded as members until 1905 when the number stood at just 9 compared with 395 foremen in engineering departments, 10 office staff and 3 works managers. On the eve of war, there were 266 rate fixers, inspectors, office staff, draughtsmen and works or departmental managers, 9.3% of the total FMBS membership. In 1923, there were 2,287 members in the same categories constituting 16.7% of the membership (eef/237/3/1/97,2)<sup>5</sup>.

### **Production Engineering**

The war increased the number of what we might call production personnel and drove some of them towards trade unionism<sup>6</sup>. But it was the founding of the Institution of Production Engineers in February 1921 reflecting 'the growing understanding that the organisation of production was now as important as the technical operations themselves' (Jefferys 1945:204), which was the logical outcome of the changes in workshop methods and management which had been developing over twenty years. The production engineer, argued E. W. Hancock, evolved from jig and tool design to become the man charged with wider responsibilities to get the best from men and machines (1926:69). There were five hundred members by 1926 and by 1939 membership had reached 2,008, rather



more than the estimated 1,800 industrial welfare supervisors and labour managers employed in industry and considerably more than the 759 practising members of the Institution of Labour Management (*Proceedings, Production Engineers* Oct. 1939; Niven 1967:81).

The production engineers were cautious about scientific management as doctrine. They were shop engineers first and shop managers second, but there is no mistaking their acceptance of its basic premises. 'As to the objects of the Institution', said H. C. Armitage of the Austin Motor Company at the inaugural meeting, 'it should be seen that it did not concern itself with the pushing of scientific management, as it was familiarly known, but they did want their workshop methods run on scientific lines and in a scientific manner, and that should be one of the principal props of their platform' (*Proceedings, Production Engineers* Feb. 1921). They favoured the British method of introducing the science of management gradually, 'from precedent to precedent rather than by revolution' (Briggs 1921). But they welcomed the second International Congress for Scientific Management in 1925 and included 'Scientific Management and its Applications' as an examination option for graduate membership of the institution in 1931-32.

The inaugural meeting had some difficulty defining the scope and aims of the organisation. Two things were clear. First, the new Institution aimed to cater for practical men 'who could not get through any examination on paper, but who were the most practical men imaginable' (*Proceedings, Production Engineers* Feb. 1921). And second, it would distinguish itself from the Institution of Mechanical Engineers which, argued J. D. Scaife, Works Manager at Ransome and Marles Bearing Company, 'deals more with the scientific side of engineering, and is not much impressed with we shop engineers who take their work and study its

manufacture' (*Proceedings, Production Engineers* 1924-5). Beyond that, the new production engineering functions remained ill defined. W. J. Hiscock drew attention to the lack of uniformity in the use of job titles in advertisements - production manager, progress chief and progress engineer were examples. In Hiscock's view the progress department was 'the first outward and visible sign of the application of scientific management to the factory' but new posts inspired by scientific management had been grafted onto existing management structures causing confusion (Hiscock 1920)

For Hiscock, the production manager was a head foreman, the man who actually delivered the product in the shop. The role of the progress chief was more fundamental. He was responsible for 'the organising and administrative work of the factory as it affects production' (Hiscock 1919). Max Lawrence, on the other hand, limited the production engineer's role to 'providing the means but not controlling the personnel or the flow of work'. He should decide on the machinery and tooling, take charge of the jig and tool design and rate fixing departments and decide on methods and processes in fitting and assembly shops (Lawrence 1921:23). G. H. Hales, works manager at Drummond Bros. in Guildford, added responsibility for the layout of the plant.

Others suggested that the production engineer was a sort of assistant works manager though opinion varied on the extent of his authority over rate fixing, costing and estimating activities. Herbert took the view that the production engineer must ultimately give way to the designer but Austin's Works Director, C. R. F. Engelbach, speaking after a trip to America, saw the production engineer as a useful check on the designer (*Proceedings, Production Engineers* 1927-1928; *Machinery* Sept. 1927). Engelbach followed Scaife in seeing the production



engineer as the man who took the engineer's work and studied its manufacture. But in his more elaborate scheme, a production manager would give the production engineer 'a priority list showing the sequence in which the tools, methods and appliances of the various details should be available'. The production engineer would then plan production, at which point 'The production manager again now takes hold of the job and commences to feed the plant with the necessary materials. He has to plan the times of what might be termed the speed of flow' (Engelbach 1928).

Typical lines of division in discussion of the responsibility of the production engineer and progress or planning departments formed around the issue of how far costing and estimating departments should be independent of production planning, and in particular, whether estimating should have some responsibility for layout before the production engineer got involved (Hutchinson 1928:60; Satchwell 1933)<sup>7</sup>. W. G. Grocock reflected the wide diversity in the actual practice of Planning Departments when he noted that 'Unless we standardise the organisations in the various works these functions depend absolutely on what the works management wants their planning department to do' (*Proceedings, Production Engineers* 1932-33). Nor were the production engineers able to resolve such differences even after seventeen years of practice and debate. Yet another paper on the functions of a planning department in 1938 opened the discussion with the observation that it was difficult to decide just what should go into the paper because of 'the utter impossibility of deciding what any given firm would lay down as planning department functions' (Jenkins 1938).

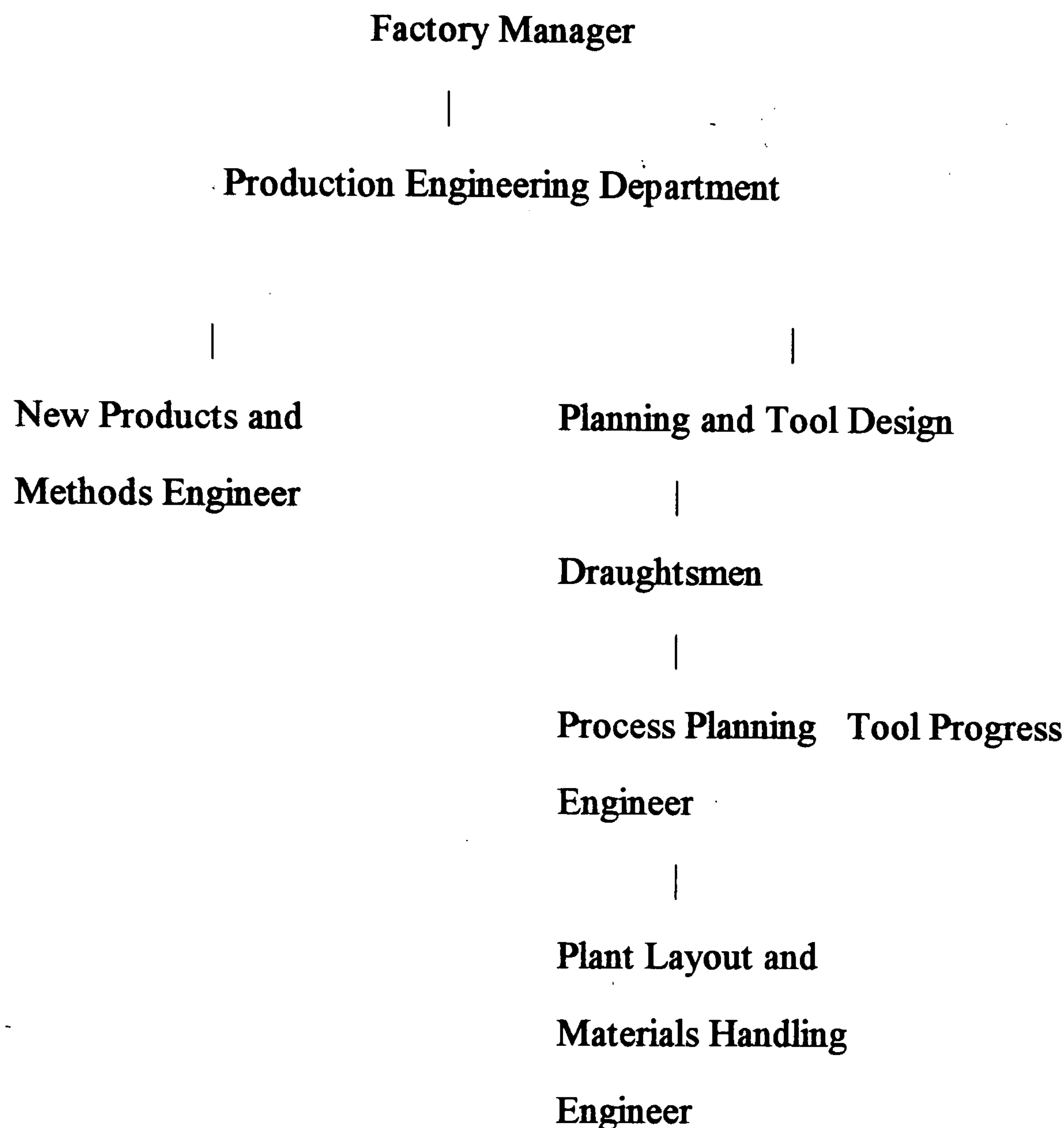
However, the question whether production planning arrangements were consistent, coherent and effective, ought not be confused with the question whether they had

developed at all. None of the production engineers were in any doubt about their own importance! Nor was there any quarrel in principle with Satchwell's description of the fundamental change which had taken place in the nature of the production process: 'In the past the subtleties of production were to be found in actual manufacture; nowadays they are to be found in the layout or plan of manufacture. If we look upon production as an edifice, we may regard the planner as the architect and his job layout as the plan' (1933)<sup>8</sup>.

The detail of the way in which this change was managed was, of course, important from a practical point of view. At Willans Works in Rugby in the 1940s, production engineers were in charge of operational planners, progress chasers and rate fixers. But Mr John Wallis, former GEC Production Director, recalls that though the management structure was modern enough, there was a lack of co-ordination: 'the designer would design something and chuck it over the wall to the manufacturing people who would regard it as a challenge and would make it at all costs' (Wallis 1993). Scientific management could clearly be more or less scientific in practice, but the management structure it brought into being was more developed than has been commonly acknowledged. At Joseph Lucas Electrical in Burnley, for example, the Production Engineering Department occupied a key position in the organisation chart (BPC Case Studies)



**Figure 1      Management Structure: Joseph Lucas Electrical, Burnley**



**The Foreman**

There was no obvious place for the foreman in this structure of management control. He became 'more a transmitter of management decisions than an active participant in them' (Child and Partridge1982:8). When the National Institution of Industrial Psychology investigated the position in 1951, they noted that while 80% of those questioned said that foremen were a part of management, the evidence from the survey 'hardly suggests that this gives a true picture of the situation if the

phrase is given a real meaning' (NIIP 1951:93)<sup>9</sup>. Put more bluntly, the development of management had left the foreman behind.

At the turn of the century the foreman ruled the workshop. Nor was this simply because he was the immediate representative of the employer on the shop floor, the person to hire and fire, to determine the pay of men and allocate the work. He was also the first among the craftsmen, the person who, with the leading workmen, would take the drawings from the design office and translate them into actual production (Herbert 1919)<sup>10</sup>. He managed both work and the worker and was an important man. In Feb. 1899 Mr Barker, one of the Directors of Forward Engineering in Birmingham, complained of the attitude of the foreman, Mr A. G. Scholes who, Barker maintained, 'did not show that respect to which he was entitled' (Forward Engineering 1899). Scholes was eventually dismissed in October but was initially defended by the other directors against Barker on the grounds that he showed great tact in dealing with society and non society men and 'was a good man in his position'.

Taylor's functional foremanship proposed a series of central roles for the foreman and initial speculation about management in Britain drew the conclusion that 'The foreman now has to think for every man under him' (*Engineering* June 1903). But functional foremanship was not the solution adopted. Instead the functions outlined by Taylor were allocated to others and the foreman's principal duty began to be defined as handling men rather than the production process. 'Slowly, almost imperceptibly, but nevertheless, certainly,' observed *Engineering*, 'a change is taking place in the characteristics of foremen in mechanical trades' (Dec. 1908). In the pre-war car industry the old style foreman and mechanic was rapidly disappearing (Pomeroy 1914). An account of the production system at the



Lanchester works at the end of the war noted that, 'In this broad outline of the system, foremen do not appear very prominently. That is because the primary duty of all foremen is the *execution* (emphasis in original) of orders for work issued to their department by the works manager' (*The Engineer* Feb. 1918).

The changing structure of management control became more apparent after the first world war as more elaborate systems of production control superseded older methods based on the foreman (*Engineering Review* 1919-1920). Almost every report told the same story. Sir Henry Fowler, chief mechanical engineer for the Midland Railway, observed that the foreman used to be in almost complete control of the shops, men, work and materials. Now,

Men are engaged by the employment manager and allocated by him to the shops. The materials are ordered and allocated to the shops by the order office. Machines for carrying out the operations are purchased after collaboration between the drawing office and the works engineer, and they are fixed in the shop by the works engineer's staff, their feed and speed being controlled by feed and speed experts. Progress of the work through the shops is governed by a planning department, its heating, ventilation and lighting being looked after by the welfare department, and any disciplining of the men has to be dealt with by the employment manager. Piecework or premium pieces are set and controlled by timers under the direct supervision of a special department, etc. Any question of dealing with labour or shop conditions is dealt with in conjunction with the shop committee (Fowler 1922).

Fowler was overstating the position by a considerable margin. Few companies, for example, will have had employment managers as early as 1923 and even more rarely will they have had the powers attributed to them by Fowler. But his generalisations went largely unchallenged because the trend he identified was so clear to all. The old time foreman, wrote A Maplethorpe in *The Foreman*, was 'a Czar in his own department'. But changes to shop management, the introduction of employment managers, rate fixers and planning departments tended to 'separate the foreman from the employees, undermine his authority and remove responsibility' (Maplethorpe 1923). Mapelthorpe's view was already distinctly old fashioned in the early 20s. The foreman was more likely to be told that the planning department would 'relieve him of worry' (Marsden 1925). Not everyone thought the foreman should be the loser in this process. Max Lawrence, works manager of the Sterling Telephone and Electric Company, argued that the new staff should be subordinated to the foreman (*Machinery* Oct. 1923). But *Engineering* struck a more authentic note in suggesting a more modest role. 'The modern trend', wrote *Engineering* in 1926, 'is to plan down to the smallest detail, but there is no reason why the foreman should not occupy a place in the scheme of things. Granted the desirability of pre-determined routing and time allowance, it can surely be left to the foreman to plan with a view to carrying these into effect' (Oct. 1926).

This seems to have been the position at the Austin where, according to Perry Keene, 'all operations are completely planned, no responsibility devolves on the foreman to follow other than the lines laid down, as this automatically produces the desired cost' (Ward w/8/13 1930). And it was the case too, at much less well known companies like David Brown and Sons in Huddersfield where the old system of relying on 'the initiative of various shop foremen working in conjunction with the draughtsman' had long been abandoned in favour of new



production and planning departments (*Engineering* May 1930). It would be too much to claim that the Austin and David Brown were typical. There is much to be said for Gospel's point that the area of production management was weak and where practical managers predominated, 'foremen continued to enjoy considerable discretion and represented a traditional pattern of authority and control at workplace level' (1992:49). In 1943, when Herberts were experiencing problems with machines obtained from Sentinel, it was the Sentinel foreman who was called in by Herberts so he could be shown 'how we avoid troubles similar to those which Sentinel have experienced' (Herberts Minutes March 1943).

But such a prominent, technical role for the foreman was already an anachronism by the second world war. At least it was for most rank and file foremen. The NIIP post-war survey divided supervision into four categories. Senior supervisors or shop superintendents would have wider responsibilities for planning and supervising the work of others. Foremen were categorised as level B supervision. Their pay differential with operatives was around £2 a week, though in 13% of cases operatives' earnings were the same as their supervisors, and in 61% of cases the best operative could earn more than the foreman in any one week (NIIP 1951:25). In interviews level B supervisors placed responsibility for the volume of production, discipline and morale higher than planning or methods of production. Of the three most important aspects of their job, 42% rated human relations first, 20% technical and 15% administration (1951:27,32). Interestingly enough, their perception of the importance of human relations did not bring them into conflict with the developing personnel function, but there *was* conflict with the functional departments which believed they did the foreman's job for him (1951:83). Despite all the talk of foremen as part of the management, the NIIP found that 'most of the



supervisors seen during the enquiry spoke of management as something distinct from themselves' (1951:94).

Coopey (1985) uses oral testimony to underline the ways in which the foreman remained a powerful figure. He was the person who represented the management to the men and was bound to appear powerful in their eyes. In some cases the foreman continued to set piecework rates. More often he would arbitrate in disputes between rate fixers and operatives about times already allocated. He might have the power to give extra time for contingencies like hard material and he certainly made a difference in allocating good jobs and bad ones. It was even possible for such power to be exercised in a brutal way. Thompson (Snr) tells the story of a craftsman sacked by his supervisor from a car body shop between the wars for arguing about his earnings. Challenged for standing over the worker while he packed his tool box, the supervisor threatened to knock him down. A shop mate recalled that '... he knocked him down. And I did see that, and that was Bobby Jones, he was a proper autocratic bloke' (1988:53). But in all these things he was carrying out the instructions of others, delivering a management service at the end of the line, without being part of the management that generated the tasks he supervised. It was small wonder that he felt that he got 'all the kicks and none of the ha'pence' (Burns Morton 1944).

Nor, despite protests to the contrary, did the Engineering Employers Federation treat foremen as part of management. Federated companies gave little support to the Foreman's Mutual Benefit Society (eef237/1/1/2.i; eef237/3/1/104). In 1947, an EEF circular designed to assert that foremen were an essential part of management only succeeded in demonstrating that they were not. Regular meetings between foremen and management were recommended to give foremen a pride in their job



and ensure loyalty. It was recognised however, that 'much work previously covered by foremen, e.g., time study, planning, rate fixing, production control, is carried out by separate departments' (EEF April 1947). The EEF's answer was that the foreman should be educated in the work of these departments and that to maintain his position, prestige and keenness, 'any instruction from the management to workers should be given by the foreman in charge to the workers concerned'. Such an arrangement was designed to maintain the appearance of a tradition of authority and control which had been transferred elsewhere.

The content of education programmes for foremen similarly testify to changing structures of management control. It was not just that certain management functions previously exercised by the foreman were being displaced. The old type of foreman was found to be increasingly unsatisfactory. 'Modern conditions and scientific management methods demand modern managers' wrote *Machinery*, and the old type of promoted foreman would not do any longer (March 1919). A particular point of attack for the modernisers was the 'deeply rooted tradition of the autocratic foreman' (Simons 1923). Someone altogether more flexible was required to implement plans from the office. 'The old type of foreman is far from being ideal in a modern factory', wrote *Engineering* (May 1923). Taylor's scheme had proved too complicated but change was needed. The old type of foreman was too resistant to change from above. Where resistance was justified, he was insufficiently analytical to explain why such plans would not work. Simple acquiescence was not any good either since intelligent implementation was required.

With the 'separation of the preparation from the execution section of the work', remarked one observer in 1921, much of the foreman's job was now in the planning



department and his real role was one of 'patrolling supervision' (*Cassiers* Jan. 1921). A report on education for foremanship in 1923 pointed in the same direction. The job of the foreman was to give instruction to the men, not 'instructions' which now came from specialist departments (*The Foreman* July 1923). The focus was increasingly turned to the management of men, to morale and the leadership role of the foreman, whose study 'gives him a deep knowledge of men and enables him to approach them in a definite manner for the accomplishment of his aims' (Gillespie 1943:5). When the NIIP considered training for foremen, it devoted a couple of pages to technical and administrative training and seven pages to human relations (1951). 'Probably seven-tenths of the value of a foreman or supervisor', wrote T. H. Burnham in his *Modern Foremanship*, 'rests on his ability to handle men and get good team work' (1937:68).

Burnham's evidence is important because he ran some of the earliest training courses for foremen at the South East London Technical Institution from 1931, and collaborated with Burns Morton, Bramley and Brech in producing a new text book for the foremen's training scheme set up by the Institution of Industrial Administration and the Ministry of Labour in 1941 (Rose 1954:97,109). Despite Burnham's criticism of Taylorism (1930:160) he was convinced that the key to modern industrial methods was 'the conveyorizing of production and assembly and the separation of the planning of the work from its execution'. He advocated time study 'because it is necessary to have a scientific measure of work and to know what is the best output that can be expected' (1937:6,115). One of the defects of Taylorism identified by Burnham was neglect of the human factor and it was in this sphere that the foreman could make a real contribution, though interestingly, this was expressed in Taylorist language. The foreman should consider himself as 'doing an engineering job on material which consists of human beings' (1937:55).



What is most interesting in Burnham is the manner in which the foreman's contribution to the management of men is reconciled with the imperatives of the new structures of management control. Burnham's foreman training was as much about reconciling the foreman to his diminished role in production as it was to encouraging his responsibility for managing the worker. On time study and rate fixing the foreman was advised that 'He must be prepared to admit that previous standards of performance which he may himself have set, based on experience .... are not necessarily right' (1937:106). On progress and planning departments, Burnham recognised that the foreman loses part of his job but thought that 'the foreman, realising the vital role of these brain centres of the firm, will co-operate to the utmost possible extent so as to assist the smooth running of the work' (p149). As to the employment department, the foreman 'will undoubtedly find it to his benefit to co-operate with his own employment officer as fully as possible' (p81).

The argument of this section has been that the rise of production engineering, matched by the changing role of the foreman points to a significant change in the structure of management control of production along lines consistent with the main thrust of scientific management prescriptions. We discuss below the evidence for how the new management operated in practice between the wars.

### **Management Practice Between the Wars**

In chapter 2 we saw how scientific management reached a peak of influence in 1921 even as British industry, released from the pressures of war, reverted to pre-war patterns of development. We noted too, the argument that Taylorism continued to influence management practice in two distinct ways: the use of time study and in the planning of production operations. In chapter 5 I will discuss time

study and payment by results, including the Bedaux system. In this section I will consider the influence of Taylorism on production management and show that, while the range and unevenness of management practice defies simple generalisations, production management existed in sufficiently developed form across a range of industries to justify speaking of the influence of scientific management whether any particular Taylorist scheme was in operation or not.

Glucksman (1990) describes as 'assembly-line methods' the management of the food processing, ready made clothing, domestic appliance, motor components and electrical engineering industries<sup>11</sup>. Oral evidence from five factories producing biscuits and electrical goods showed that there was a high level of mechanisation, extreme fragmentation of tasks, an extreme sexual division of labour with skilled men servicing a predominantly female production force, strict supervision and the widespread use of the Bedaux system. At Morphy Richards, for example, each job was timed to take about a minute (1990:133).

In the motor industry production was also organised along scientific management lines. At the Austin in 1934 a master order originating in the production department was sent to the Efficiency Department 'which is thus enabled to see what new parts are coming into production and to decide what route they shall take through the various shops' (Ware 1934). The financial controller at Austin, Perry Keane, claimed that the volume of work produced in 47 hours in 1933 was seventeen times that produced before the war in 54 hours, and that 'This great difference has been brought about by scheduling, measuring, and re-measuring every single operation contained in the day's work, though we have 157,000 different types of operation' (Ward w/8/29-34/12 June 1933a). Austin employed the services of an industrial consultant, A. J. Brandt, to advise on the logical flow



of work and the elimination of unnecessary processes (BT56/44/CIA/1884/2). Morris, apparently, did not even employ a standards engineer or an experimental engineer until 1949 (Overy 1976:82). But Morris' methods were 'Tayloristic' (Tolliday and Zeitlin 1986:38) and the time for tasks carried out by workers entirely in the hands of employers (Whiting 1983:31). With F. G. Woollard at Morris, and C. R. F. Engelbach at Austin, both companies employed outstanding production engineers.

The picture was not uniform across the whole of the industry. According to Tolliday, even after the war 'Jaguar were still making pre-war quality models by pre-war methods' (1986a:219). And despite using Bedaux at the Tysley plant in the 1930s, Rover only introduced assembly line methods in 1946 (Whipp and Clark 1986:70). But the largest producers, Austin and Morris, were leading practitioners of scientific management methods. Woollard's paper to the Institution of Automobile Engineers on British methods of continuous production 'created quite a stir among production engineers' (*Machinery* Feb. 1925). In it he argued the case for flow production even where quantities to be produced fell far short of those in the American industry. The key was the mechanical movement of the workpiece under time control, 'The mechanised movement is a metronome which beats out time for the whole of the works ..... If used wisely it sets a pace which in itself it helps to maintain; it discovers weak spots in the organisation, and shows up inequalities in method which, once visible, good management can quickly remedy' (Woollard 1924). In a further development of his ideas, Woollard argued that even producers of quite small production runs could take advantage of flow methods by grouping components to permit the layout of machines in operation sequence. But at bottom, efficiency, Woollard argued, 'is largely a matter of timing, and the virtue

of the flow line resides in the fact that it helps us to take control of the time we are buying' (1954:42,85).

Engelbach was just as concerned with time. 'Our efforts', he wrote, 'have been concentrated on reducing operation times by minutes and seconds. New plant, new machines, new devices to save time in machining or handling; new methods, new processes and new ideas on organisation have flowed unchecked from the brain of the engineer' (1933). Engelbach was truly a man in the Taylor tradition. In 1933 he conducted experiments to discover the difference between the weight of materials bought in and the weight in material finally delivered to the customer. In the case of a seven horse power saloon, he found that of 22lbs of paint drawn from store, only 2lbs adhered to the finished body. The figures were probably produced by the Efficiency Department. 'Our Efficiency Department is really the works', wrote Engelbach, 'The department works out the principles and methods of manufacture of each article to the smallest detail' (*Proceedings, Automobile Engineers* 1927-28).

There is evidence of similar developments in the management of production in bus and tram construction, and in railway workshops and carriage building. At the Chiswick Repair Works of the London Central Omnibus Company in 1923, buses entered the works in a bus de-mounting department. In a highly organised operation the chassis proceeded down a line with component stripping and servicing bays placed at right angles to it. Assembly reversed the process allowing a fine division of labour between strippers, viewers and assemblers (*Cassiers* Dec. 1923)<sup>12</sup>. At Short Bros. in Rochester where the bodies for the London Omnibus company as well as car bodies for Citroen and Renault were made, the standard bodies were all manufactured with jig processes, using little skilled labour (*The*



*Engineer* July 1923). The description of production methods at Short Bros. was similar to that at the Derby Railway Coach works of the London, Midland and Scottish Railway, 'two somewhat similar woodworking schemes both organised by engineers' (*The Engineer* Oct. 1923). Where the skilled body maker had once marked out every piece of timber individually, the use of jigs and the machining of parts to accurate limits now entailed the marking out of only one part and the duplication of the rest. Carriage parts were assembled on a locating jig, squeezed together with compressed air cylinders, and fixed by a screw driving machine (*Engineering* Oct. 1923). A visiting delegation from the National Union of Vehicle Builders reported that they had been 'impressed beyond measure as they saw the skill of the hand craftsman carried through by jig and machine in minutes that once represented hours of skilled labour' (NUVB Oct. 1923). R. W. Reid, the chief carriage and wagon superintendent, claimed to have reduced the time taken to build a carriage body from six weeks to six days. An even more streamlined operation was run at Derby in the construction of railway wagons, with the wagons moving between work stations on the assembly line principle (*Engineering* Dec. 1923).

Drummond has argued that the post-war re-grouping of railway companies brought railway workshop re-organisation in the 1920s (1989:25). Certainly the London, Midland and Scottish Railway was said to have abandoned pre-war traditions in railway workshops as well as in carriage construction, a view supported by the claim that the LMS was 50% cheaper than continental railways (*Engineering* Aug. 1930). At the Crewe locomotive works in 1928 the work was moved to the man, again on the assembly line principle, with engines hauled down the shop by electric winches through eight work stations. The layout of the works, said one commentator, was designed to process the work with as little movement



and labour as possible, 'and that a time had been fixed for the various operations, in accordance with modern ideas in manufacturing shops' (Beames 1928). Similarly at the Acton works of the underground railway the progressive system was given a trial in 1924 with work moved through successive stages on bogies (*The Engineer* Feb. 1924).

Substantial accounts of the structure of management control and its operation, whether at the level of an industry or company, are rare. But there are numerous references throughout the periodical literature to elements of a systematic, if not scientific, management. In 1920 the AEU reported that Harper Bean in Tipton were 'trying to introduce mass production methods as in America' (AEU Reports April 1920). At the heavy engineering company, Davy Bros. in Sheffield, where there was virtually no repetition work, there was a works planning department, charts and progress cards, predetermined feeds and speeds and a rate-fixing department (*Machinery* Aug. 1923). At Herbert Morris in Loughborough in 1927 some progress had been made in standardising drawings, there was a progress and tracking department and a system of job cards provided by the planning office (*Engineering* June 1927). At David Brown and Sons in Huddersfield 'the sequence of operations was laid out by a staff of men having works experience' in planning and production departments (*Engineering* May 1930). Anne Shaw, the motion study expert who trained with Lilian Gilbreth in America, worked at Metropolitan Vickers in Manchester, and 75% of the boys being trained were given six weeks in the motion study department to encourage orderly arrangement of work (Fleming 1937).

How far such scattered examples provide a reliable guide to management practice is difficult to say. But as early as 1923, P. J. Pybus, managing director of English



Electric claimed that 'The whole of the internal organisation of many of our largest factories has been revised and in many cases entirely changed .... In the best type of factory in Europe or in the United States many of the plants so nearly resemble one another as to surprise the expert of any one particular nation or class of producer who visits both' (AEU Reports Aug. 1923). Visits organised by the Anglo American Council in the 1940s confirmed a comparability among larger plants, though they still found significant differences in terms of the extent of mechanical handling. Differences in levels of mechanisation and managerial sophistication were more marked in the smaller and medium sized companies. But not all such companies can be written off as a managerial dead loss. Those associated with the Management Research Groups, like Baker Perkins and Imperial Typewriters, had production planning and rate fixing departments and a number, like Venesta, High Duty Alloys and British Xylonite had used consultants to establish standards of production (Ward w/2/5 June 1937).

### **Case Study Contrasts**

Littler's argument that 'the history of scientific management in Britain in the inter-war period is largely the history of Bedaux' (1982:108) provides far too narrow a focus. There were no Bedaux engineers in the big car companies nor at the Rowntree Cocoa Works where, according to C. H. Northcott, scientific management had been tested 'with the workers educated to accept it as a procedure, philosophy and idea' (1937)<sup>13</sup>. At companies like Manders Paints and Lucas, Bedaux was part of a wider process of management reorganisation. At ICT's metal companies, Bedaux was grafted onto inadequately developed management structures. In this section I will illustrate something of the range and unevenness of production management as it developed between the wars.



Manders Paints in Wolverhampton signed an agreement with the TGWU's Ernest Bevin in 1932 which introduced the country's first forty hour week 'concurrently with the introduction of a scientific planning system' (Mander p255). The Bedaux company provided the scientific planning, in the first instance in the Heath Town Paint Department, where work was to be 'timed and controlled by a system known as work units' (Mander p207). A year later the system was installed in the paint factory, warehouse and despatch departments, and the dry colour works, and plans laid to extend it to the office (Ward w/8/29-34/12 June 1933). Despite the company's claims for it, Bedaux seems to have been a mixed experience. Geoffrey Mander told the Management Research Groups that calling in an outside firm of advisors had been 'a first class blunder' because they were a red rag to a bull for the trade union movement. According to the local TGWU official, less than half the productive workers were on the forty hour week in 1935 and an attempt to spread the system provoked a strike (Lab2/2061/IR1441/1938). But Manders remained terribly proud of their 1932 agreement which attracted national attention.

In 1935 Geoffrey Mander was the UK spokesperson at the sixth international congress for scientific management in London. His interest in scientific management can be traced to the work of the National Institution of Industrial Psychology<sup>14</sup>. Though critical of American efficiency experts he had long been interested in what the company's journal called 'the new science of the psychology of industry', the study of fatigue and rest periods and 'the economy of movement', as well as vocational selection and 'general factors determining efficiency of work' (*The Green Can* Oct. 1921). Manders' managers (and employees) were regular participants at the Oxford management conferences and Eric Farmer, the time and motion study expert from the Industrial Fatigue Research Board, conducted a series of experiments in 1922 in the can department 'with a view to reducing



fatigue to a minimum' (*The Green Can* May 1922). In the case of Manders, engaging Bedaux in 1932 was entirely consistent with longer term developments.

Bedaux was introduced at Lucas in 1931 but ten years earlier a management re-organisation was undertaken which aimed to increase the degree of specialisation, set up a planning and progress department and meet the need for a more scientific procedure. A works accountant was appointed to improve the flow of information and to provide a week by week wage analysis breaking down labour costs for different operations for each shop, and an outside consultant, Robert Stelling, was engaged to prepare a report on the introduction of a planning department (Lucas Minutes June, Sept., Oct. 1921). Stelling may have demanded too radical a re-organisation. He had been critical of British managers for half-hearted implementations of the Taylor system, including so-called planning departments consisting of one clerk in a progress section (Stelling 1919). At any rate, his preliminary report was received early in 1922 but does not seem to have been acted upon.

It is clear nonetheless that Lucas was making efforts to streamline its management and apply the lessons of the American experience. The managing director, Peter Bennett, defended the level of non-productive wages in 1921 as 'part of our deliberate aim. As we express it "we intend to spend money at the front end of the job" and to cut out work in the later stages' (Lucas Minutes Nov. 1921). Trips to America by Oliver Lucas and other managers kept the American example constantly before the company. Following one such trip in 1926 the Board noted that 'It will be readily understood that it is quite impossible to take any ready made system, but what we can and do expect is to apply the principles which have been successful in the light of our own requirements' (Lucas Minutes Sept. 1926). The

first conveyor was installed at Great King Street in 1924 and new production methods were 'developed in the factory by a new department of methods engineers started by R. G. Purcell, adding up to the beginning of mass production of components to keep pace with the expanding motor industry' (Nockolds 1976:186). The company was sufficiently confident in its own methods that when CAV was taken over in 1926 shop floor layouts, office, works and cost systems were completely re-organised along Lucas lines (Lucas Minutes 1926). In 1927, another Lucas manager, Bertram Waring, installed a new open plan office with 'Veeda counters on the typewriter keys and a method of counting the number of ledger postings' (Nockolds 1976:209).

Management methods were clearly well developed before Bedaux was called in and though Bedaux was important, it was in the stimulus to more thoroughgoing management re-organisation that Bedaux made the biggest impact. Albert Sidall, head of the process planning department, described how the Lucas Point Plan System (the successor to Bedaux) and the time-study department led to a fundamental change which found expression in a new Process Planning Department. His description is worth quoting at length:

This was the beginning of a modern management system distinct from the old Lucas system. The technology, instead of being organised on the shop floor, was decided by people working outside the shop who determined how things should be made and what equipment should be used for making them. The previous system was based on the shop foremen or superintendents. They were the manufacturing management, men of all work - and some of them were damn good, I must say - they decided how the job should be done, they decided what equipment would be needed, in



many cases they actually made the equipment themselves in their own small toolroom or they told the main toolroom what they wanted; they fixed a time for the job, and dealt with the social problems of the people - they dealt with every aspect of the manufacturing scene. The Process Planning Department started with two or three people, and gradually built up until it became quite powerful. It really made decisions on how things should be made and what equipment should be used, and that had quite a revolutionary effect on the manufacturing times and the overall efficiency of the plant and its profitability. In the early stages manufacturing times were reduced by half on a big scale, and the tools were made differently (they were designed on the drawing board instead of ad hoc, as it were). By introducing a professional body of engineers to look after the technology of manufacture, the process planning system was really the beginning of a modern production engineering system. It also had a big effect on the overall management structure, because you couldn't make a change like that, without taking in the whole of the manufacturing system, which grew from a complete line management to a line-and-staff management (quoted in Nockolds 1976: 209).

Sidall's testimony brings together many of the themes we have been discussing including the changed position of shop foremen, the new role of design office staff, professional engineers and production planning. It also suggests a perspective on the contribution of Bedaux. Time study was actually the crucial element, Bedaux the form it took. Both were part of the broader development of production management. In 1944, Lucas provided an endowment for a Department of Production Engineering at Birmingham University. The Chairman explained that 'the Management had been very conscious of the fact that in connection with

Production Engineering there have been no established principles for its basic functions and that the principles adopted by the company were either worked out within the organisation or were introduced through Consulting Engineers' (Lucas Minutes March 1944). Britain needed the supply of trained production engineers that were produced in the technical universities in America.

Herberts provides us with a significant contrast. Herberts helped turn the tide of American competition at the turn of the century and grew to become the largest machine tool manufacturer in Europe. Its tools were at the heart of a mechanisation process, intimately linked to changes in the division of labour and management. One might therefore have expected Herberts to have adopted the American methods which appeared to go with the tools. But instead, a number of authorities have characterised Herberts by the firm's paternalism and managerial conservatism (Davies 1986; Grainger 1988; Tolliday 1986a). Herberts represented an increasingly unhappy mixture of modern and traditional production practice with key changes in production planning and organisation coming very late in the day and at a time when the firm was already falling behind in machine design.

Alfred Herbert was acutely aware of modern production trends, not only those coming from America, but trends generated by changes in technology and shop practice, the new role of the drawing office and the tool room and the need for standardisation. He was aware too, of the need for repetition methods to be employed wherever possible. Capstan lathes were being built for stock rather than to order in 1911 and efforts were being made to reduce 'the number of different combinations in which our machines are offered' (Herberts Minutes Sept./Oct 1911). There was already a substantial toolroom producing jigs and special tools in 1897 when the works were reorganised by an American engineer, Oscar Hammer



(*Engineering* Dec. 1898; Saul 1960:25). Towards the close of the war Hammer was preparing new plans for a range of machines which could be 'continuously produced' and those which were to be produced in batches, and the company was preparing to risk the loss of some business in order to reduce its reliance on American imports (Herberts Minutes Sept./Oct 1917). In 1918, prompted by a series of articles by Horner in *Engineering*, Herbert was pressing the Board to investigate 'the possibility of developing a system of standardised jig making' (Herberts Minutes Oct. 1918). The following year an article in *Cassiers* offered the company as an example of modern engineering practice. In particular it was argued that costs and production progress was assured because every operation was timed. There were detailed instructions for the worker which told him 'exactly what to do, the method of doing it, and the time and cost involved' (*Cassiers* 1918/1919). In the same year, the efficiency expert, H. N. Casson, was called in to prepare a report and it was arranged that he should deliver a series of six lectures (Herberts Minutes Oct. 1919).

Herbert's market made continuous production methods more difficult than they might have been. In 1912 the Board decided that no more orders would be taken for jig boring machines but bowed to the pressure of demand and continued to produce them. As late as 1920 Alfred Herbert was still arguing that even an order for one such machine could not be refused (Herberts Minutes March 1912; April 1918; Nov. 1920). Similarly, in 1924 Herberts felt obliged to put back into production items insisted upon by large customers (Herberts Minutes Aug. 1924).

But if the market constrained management choice it did not determine it. Nor could market pressure justify the company decision in 1921 not to re-appoint a production engineer. The post was 'suspended in the cause of economy and would

be reinstated as soon conditions justify' (Herberts Minutes Aug. 1921). Board minutes make no further reference to this post until 1941 when it was recorded that the production department was being reconstituted under Mr Bromley, who was now back as production engineer, though still head of the sub contract department (Herberts Minutes Aug. 1941). What had happened to production planning and organisation in the twenty years that had elapsed? There are few clues. Oral evidence in Grainger (1988:97) suggests that there was a planning department in the 1930s. But there is little doubt that modern production engineering practice was neglected with flow production methods hampered by grouping machines according to type (*Machinery* Nov. 1928).

With re-appointment to the production engineering post efforts seem to have been made to streamline production by cutting out alternative machine models, and by introducing a piece-part system to facilitate 'the manufacturing of individual articles for stock and building up assemblies from those stocks' (Herberts Minutes Oct. 1942). In 1944 the Board was finally discussing proposals for reorganisation of machinery into a number of complete manufacturing sections 'each capable of carrying out all the operations on a selection of units' (Herberts Minutes Jan. 1944). Each section would work to a planned timetable, ensure that work flowed from one machine to another and to the fitters without accumulating anywhere, and the workers on each section would be expected to operate as a team, being prepared to carry out different operations.

The records do not indicate whether this plan was implemented in detail but a Planning and Production Control Department was established in the same year<sup>15</sup>. In 1946 when the new department was criticised for creating extra work and paper it was defended by Alfred Herbert, but in terms which suggest that some basic



questions had remained unresolved. 'It is necessary', argued Herbert, 'to draw up a logical scheme of responsibility, and whether the appointment of a production engineer is advisable and whether he should be the same individual as the system man, combining both functions, is a most difficult problem to solve' (Herberts Minutes Feb. 1946).

ICI and its Midlands group of metal companies provide another interesting contrast. ICI was, by the 1930s, 'a modern decentralised corporation with a functionally specialised head office exercising overall financial control and providing managerial and financial services to the divisions (groups)' (Hannah 1976:94). One such service was that provided by the Chief Labour Officer, another the application of time study and efficiency systems, particularly after the employment of the Bedaux company in 1929, though some of ICI's policies were better received in subsidiary companies than others.

The Delegate Board of the Metals Group must have been a source of constant frustration for ICI's Chief Labour Officer. In 1930 the group rejected the Labour Officer's invitation to increase the percentage of staff grade workers (May 1930); rejected the suggestion that the group produce a periodic labour report similar to that in the Chemical group (June 1930); and suggested themselves that the Central Labour Office cease to provide reports on accidents and sickness absence (July 1930). The following year the Metals Group expressed the view that there should be no changes in pension or redundancy arrangements if it increased costs (Jan. 1931); they were not impressed with a Labour Office suggestion that there should be a period of notice before termination of employment (Feb. 1931) and were still resisting the policy of one week's notice three years later (Aug. 1934). In 1935 the Board could not agree to accept ICI's more generous holiday entitlements (Feb.

1935) and the following year recommended that women be excluded from ICI's new pension scheme (Feb. 1936). In 1937 the Board rejected Labour Office suggestions that pay increases granted by the Engineering Employers Federation should be augmented to bring the metal group more into line with other ICI companies and opposed proposals for improving factory amenities (July and Oct. 1937). Even by the standards of the time the members of the Delegate Board seem to have been hard men. Their minutes solemnly record that 'no serious accidents' occurred in April 1934; those of a less serious nature included an employee unconscious for half an hour having been overcome by fumes and the amputation of the ring finger on another employee (May 1934).

They were more sympathetic to Bedaux's system of labour management which was introduced into a number of the Metal Group companies, including Lightning Fasteners, Allen Everitts, Holfords and John Marstons in Wolverhampton. At Marston's in 1935, there were 289 workers out of a total workforce of 669 on Bedaux, the largest number being 122 in the machine shop (Marston Minutes 1935). But in complete contrast to ICI, and companies like Lucas, and even Manders Paints, production management at Marston's seems to have been primitive. In the same year that Bedaux engineers were at work, the Marston Board was debating 'the advisability of engaging a man experienced in works management'. One of the members, Mr Dalrymple, thought it unnecessary since if he had more clerical assistance he could concentrate more on the production side (Marston Minutes 1935). Two years later Marston's were considering employing an expert in the press shops and 'it was considered that a cost man should be engaged with technical knowledge who would be competent to control rate fixing and provide basic information for estimating and assisting in the control of production costs' (Marston Minutes 1937).



There may have been more progress for the metal group as a whole. A Metal Technical Committee was established in 1934 to be responsible for technical efficiency and changes in work processes (ICI Aug. 1934). Two years later there was a further reorganisation with new appointments to a Metal Progress and Planning Department.

In reviewing the practice of firms like Herberts and ICI, Lucas and Manders Paints, this section has sought to demonstrate that scientific management encompasses a range of experience that defies simple generalisations. Some companies that adopted the Bedaux system had developed production management structures, some did not. Herberts - a case of arrested development - moved away from production engineering at a time when its importance in industry more generally was growing. ICI's sophisticated management structure and policy did not necessarily operate as it was intended to do in some of the devolved outposts. While we have concentrated on gathering and presenting the evidence to show that the development of production management and new management structures of control operated much more widely than is commonly allowed, it is clear that the development was extremely uneven, came very late in many cases and not at all in others.

### **Scientific Management and the Management Movement**

John Child has argued that 'the new literature, and the activity of the management movement at the Oxford and similar conferences, continued to remain alien to the great mass of practising managers and employers' (1969:103). Membership of management Institutions was minimal and there were continuing complaints of conservative individualism among employers and indifference to new ideas.

Focusing on the labour movement Price similarly concluded that 'The impact of scientific management did not establish a self confident and distinctive managerial identity'. And although scientific management 'entered decisively into British industry' it failed to disturb traditional social relations of production (1986:180-181).

This picture is overdrawn. It is true that elements of scientific management continued to be absorbed by a largely pragmatic management rather than management being transformed according to a definite body of principles. The uncertainty of production engineers about their role underlines the diversity of practice and suggests its uneven quality. And there is plenty of evidence for the conservative individualism to which Child referred. Production management was still substantially behind America when the Anglo American Council conducted its visits, but it was quite different from what it had been before the first world war. The changing structures of management control and production management discussed above are in themselves evidence of changed practice, and it is difficult to see how scientific management could enter decisively into industrial life without disturbing social relations of production.

The first attempt to establish an organisation representative of *management*, rather than one or another of its particular functions, was a dismal failure. The Institution of Industrial Administration was founded in 1919 but by 1923 its work was at a standstill and it had collapsed altogether by 1924. Nor was industrial consultancy significant in the twenties. T. G. Rose, the historian of the IIA and an industrial and engineering consultant, could only add three names (one of them E. T. Elbourne) to a list of industrial experts being compiled by the Board of Trade in 1931. Rose's efforts brought the Board's total to seven (BT/56/44/CIA/1884/5). However, there



was no shortage of organisations with a particular or sectoral focus for British managers, including a host of Institutions for Civil, Mechanical, Electrical, Automobile and Production Engineers and Cost and Works Accountants to name only the most prominent. In 1927 Rowntree helped establish the Management Research Groups, as he had earlier established the Oxford Management Conferences.

Interest in management grew in the 1930s. In 1931, the welfare workers changed their name to the Institution of Labour Management and in the next two years associations were established for Works Managers, Purchasing Managers and Office Managers. In 1935, a Confederation of Management Associations was founded which attempted to link a number of these organisations and tried, though without much success, to develop its own examinations and professional standards (Rose 1954:87). E. T. Elbourne's, *Fundamentals of Industrial Administration* (1933), was designed as a text book for the first stage of the Institution of Industrial Administration syllabus, which had itself been remodelled to fit in with the syllabus of the Institution of Mechanical Engineers, and later, the Institution of Electrical Engineers (Rose 1954). There is a strong case for regarding Elbourne's writing, with its advice on planning and process control from a central office and time study to find the best way of working and reduce fatigue and costs, as constituting a kind of conventional wisdom on questions of workshop management and organisation by the mid 1930s (Elbourne 1934).

If all this activity only just added up to a management movement it was sufficient to command widespread support throughout industry and commerce for the Sixth International Congress for Scientific Management held in London in 1935, which in

turn led to the establishment of the British Management Council and eventually to the founding of the British Institution of Management in 1948.

The 1935 Congress was not the first that attracted British participation. Twenty eight delegates from Britain had attended the second international congress in Rome in 1927 (there were 32 from the USA), where Urwick gave a paper drawing attention to the work of the Industrial Fatigue Research Board and the National Institution of Industrial Psychology (*Engineering* Sept. 1927). British preparations for the sixth congress were on a rather grander scale. Two hundred and twenty seven companies subscribed to congress funds including Ford, Morris and Austin from the car industry; the major banks like Barclays and Lloyds; retailers like Sainsbury and Debenhams; and manufacturers from Bibby through Lucas to Mather and Platt, Raleigh and Vickers (mss/200/F/3/52/10/25). Participation was clearly no guarantee of commitment to scientific management. Courtaulds, whose management had been positively hostile to Taylorism, attended alongside Lucas where the Bedaux company had been called in a few years earlier. Nevertheless, the scale of support is impressive and significant. If there had been a derisory level of interest in scientific management it is unlikely that the organisers would have risked a London venue. The congress was a prestigious national event - opened by the Duke of Kent - and one that companies in the public eye were keen enough to support. It also suggests the degree to which scientific management had become synonymous with management itself.

A committee for the seventh congress was established immediately afterwards headed by Lord Leverhulme who, as the designated president for the congress, was concerned that there should be a central co-ordinating body in Britain to mobilise support. After a good deal of in-fighting about the role of such an organisation a



British Management Council was formed in 1937 to ensure British participation in international bodies. Although the Federation of British Industries had helped convene the early meetings, they took little further part and there were complaints that it was difficult to get the support of manufacturers. The various professional bodies were more interested but they had no money. Despite these difficulties forty one companies attended the seventh congress in America in 1938 where Urwick presented his paper on *The Development of Scientific Management in Britain*. In 1944, the British Management Council, the Institution of Industrial Administration the Confederation of Management Associations and the Management Research Groups, together with a number of professional bodies, took the first steps leading to the formation of the British Institute of Management (Rose 1954:127)

### **Scientific and Labour Management**

In remarks to Production Engineers, Baliol Scott, Leverhulme's Secretary on the Committee for the Seventh International Congress for Scientific Management, claimed that 'It is on personnel problems that this country has probably the greatest contribution to make' (*Proceedings*, Production Engineers May 1938). It was always a dubious claim but its substance has been repeated many times (Merkle 1980; Mant 1977; FitzGerald 1988)<sup>16</sup>. There is in fact a widespread assumption that the crude notion of economic man in Taylor's thought, and the unforgiving reduction of the worker to a defined task in Taylor's practice, was displaced by more sophisticated industrial psychology and labour management strategies. It was just such an assumption that Braverman attacked so vigorously in describing the practitioners of human relations as 'the maintenance crew for the human machinery' (1974:87).

If Braverman's comment underestimates the influence of human relations it is not mistaken about the complementary rather than competing nature of the relationship between scientific and labour management. Jacoby describes production management and human relations in America as two contending forces but notes that 'Several of the nation's first personnel departments were sited in firms with strong ties to Taylor'. The Taylor Society itself was dominated after 1915 by people committed to 'combining progressive social ideals with efficient management practices' (1985:47,102). Indeed, in 1920 the Taylor Society endorsed collective bargaining by both trade unions and shop unions and the AFL in turn endorsed efficiency (*Mechanical Engineering* Jan. 1920; Nadworny 1955). In Britain, welfare strategies 'were increasingly used in the newer industries in which Taylorism and Bedaux were strongest' (Jones 1983:72).

Scientific management was a 'progressive' movement<sup>17</sup>. Its enthusiasts denounced the conservatism of employers as well as workers. They attacked the lump of labour fallacy but also demanded high wages for productive work; criticised laissez faire and lauded planning. They offered a vision of social and industrial peace based on worker and employer co-operation in generating a surplus big enough to have no need to argue about its distribution. Scientific managers were *more* likely than others to welcome new ideas about human relations because they were seen, by Taylor's successors, as an extension of the science of management. There are few ideas more mistaken than the notion that scientific management was inconsistent with human relations, trade unions and collective bargaining, or with the host of management strategies that followed Taylor (Waring 1991).

Criticism of Taylorism for its neglect of the human factor was commonplace, but this phrase must be treated with extreme caution. It was used to refer to the



management of workers as machines rather than people and to the specific activities of welfare workers. But it was also used by motion study experts to stress the need to discover the most efficient motions in order to reduce fatigue. The neglect of the human factor was a slogan used as often by those urging their own special brand of scientific management as it was by committed opponents. We will examine briefly the inter-war development of the management of the human factor by welfare workers and industrial psychologists, and argue that the latter offered their own form of scientific management as an improvement on Taylorism, not an alternative to it. It is also argued that despite the efforts of both, labour management was more weakly developed than production management before the second world war.

Inman records the following comment of a managing director of one armaments firm faced with the state's efforts to promote personnel management in the second world war: 'I do not quite understand the reference to "personnel management". I object to the word "management" and I do not have a personnel manager in my works. I do not see how anyone who is not responsible for production in any way can "manage". We do however, have supervisors or superintendents dealing with welfare matters' (1957:263). Even among more progressive employers scepticism about personnel management was not uncommon. Personnel managers at Lever Bros. and Rowntree, observed one critic at a Management Research Group meeting, only *thought* they controlled matters that were really in the hands of the production men (Ward w/8/29-34/12 Jan. 1931). Nevertheless, two overlapping developments between the wars were laying the foundations for the growth of personnel management during and following the second world war.

The move to establish the Welfare Workers Association was initiated at York in 1913 and confirmed at a conference in Leeds in 1917, with interest in the movement significantly enhanced by the activities of the welfare department of the Ministry of Munitions and the reports of the Health of Munitions Workers Committee. In 1918 Robert Hyde founded the Industrial Welfare Society which became, in 1965, the Industrial Society. The Welfare Workers remained a separate organisation but was renamed the Institution of Industrial Welfare Workers in 1924 and again as the Institution of Labour Management in 1931, adopting the modern title of the Institution of Personnel Management in 1946. 'The turning from welfare by way of employment to labour management' (Niven 1967:80) which took place in the 1920s was foreshadowed in early claims by the Welfare Workers post-war secretary, Miss E. B. Voysey, that welfare workers were a part of management 'on a par with the accountant, engineer and other officers' (mss/197/1/ec/1/1).

The welfare work stream that fed the personnel management movement was distinct from scientific management but not inconsistent with it. Voysey told the Industrial Reconstruction Council that the functions of welfare work and scientific management were complementary (1919:11). The 'marriage of welfare and management' (Whiteside 1980) was sold to employers as 'a business proposition pure and simple' (*The Engineer* Nov. 1916). Companies like Renold were prominent in founding the Welfare Workers Association alongside Rowntree, WD&HO Wills, Vickers, Armstrong and Hadfields. Among the presidents of the organisation were C. H. Northcott who had educated Rowntree's workers to accept scientific management, and Anne Shaw, the prominent motion study expert at Metropolitan Vickers.



The immediate post-war years were marked by a heightened awareness of employment management. In 1918 *Machinery* called for a production man to be directly responsible 'for labour and its management as a specialist activity. He should be the paid representative of the men, his salary being provided by the management' (March 1918). Post-war labour disputes concentrated the mind. 'Our present method of handling labour questions', wrote *The Engineer*, 'reminds us of the condition of the art of steel making before the new science of metallurgy was born'. A new science of industrial sociology was required to understand the periodic disturbances and rebellions in industry for 'not until we know the laws of industrial life can we hope to control it' (Jan. 1919). There was a need, thought *Engineering*, for an employment manager, someone who would probably be regarded by the superintendents as a revolutionary and by the men 'as a plausible fellow who is endeavouring to entice them into the parlour of the capitalist spider .... he is the head of what might be called the Industrial Relations Department' (Jan. 1921). In America, the personnel function grew slowly in the 1920s and fell back sharply in the depression after 1929. In Britain, the anticipated development of labour management fell victim to the earlier depression after 1921. Welfare supervisors and labour managers had to justify their existence. The movement was forced to mark time and in 1939 'there were still more welfare supervisors than labour managers' (Niven 1978:71,81).

### **Psychological and Scientific Management**

The second group of people focusing on the human factor were the industrial psychologists of the Industrial Fatigue Research Board (later the Industrial Health Research Board), and the colleagues and associates of Charles Myers at the National Institution of Industrial Psychology. Founded in 1918, the IFRB grew out of the work of the Health of Munitions Workers Committee. The board produced

84 special research monographs between 1918 and 1939 with its interests shifting in the 1930s from work methods, including time and motion studies, to vocational psychology (McIvor 1987:167,169). The NIIP, founded in 1921, worked closely with the IFRB and was engaged in much the same field of work. The NIIP also moved from motion study to pay more attention to work layout, promotion, pay, discipline and to questions of morale and 'atmosphere' in the 1930s (*Machinery* March 1930; *The Engineer* Dec. 1936).

McIvor stresses the genuine health preoccupation of the psychologists and their contribution to the exposure of the scientific crudities of Taylorism citing Sir David Munro's 'vituperative attack on the efficiency engineers' labour management techniques' at the 38th Oxford Management Conference (1987:174). Sir David, secretary to the IFRB, had told the conference that he did 'not believe that one can tick out the seconds of human work like a clock ticks out seconds'. He was equally critical of payment systems 'cunningly employed as an incentive in speeding up production'. Whether this was a particularly vituperative attack may be a matter of judgement. But when challenged by Anne Shaw, who defended time and motion study, Sir David beat a hasty retreat. He readily agreed that such studies may not be doing any harm and that, of course, 'they were instituted entirely to save workers from making unnecessary movements - unnecessary effort. All I did say was that they are very easily exploited' (*British Management Review* July/Sept. 1938).

The criticism offered by the psychologists did not concern motivation but the Gilbreth notion of the one best way and the way in which time and motion study should be used. Eric Farmer of the IFRB underlined the differences in reporting his study of sweet dipping in 1922. The purpose of time study, he argued, was to



ascertain the time it took to complete an operation, not to set a time; motion study was used to identify the movements which, once learned, would be easiest for the workers to perform, not necessarily those which were quickest or involved the shortest travel. The aim was to see whether the combination of psychological and physiological research could alter and improve methods of working. In the case of sweet dipping unproductive time was cut from 21% to 7.44%, principally by using a larger tray for the sweets and ensuring regular supplies of sugar (Farmer 1922).

Charles Myers, who headed the NIIP and was on the Board of the IFRB, put forward a more systematic critique counterposing psychological to scientific management<sup>18</sup>. The latter, he argued, was a failure in Britain. The workers opposed it and management were critical because it failed to deal with the human aspect. Taylor was called in aid to prove that scientific management required an ox-like man who would be reduced to the level of a machine. Scientific management had made a great contribution to improved organisation but the merely mechanical innovations of the engineer or technical expert were fraught with danger. His solution was not to dispense with Taylorism however, but to supervise it. 'Scientific management', he concluded, 'needs to be supervised and controlled by psychological management' (1920:773). In part it was a problem of the 'tactlessness of Taylor's genius', though Myers critique did go deeper (1932:13). The aim of industrial psychology 'was not to speed up the worker directly, but to obtain increased output by discovering the most effective methods of work, eliminating the needless movements, wasteful energy and friction' (*Cassiers* Nov. 1923). There was no one best way argued Myers, since it was a mistake 'to force all workers into a common mould'. And efficiency experts were attacked because their 'mechanistic attitude lead them rather to time study the worker as if he were a machine, to set hourly or daily tasks which an efficient worker should be expected to perform and

to devise elaborate systems of payment which, in their mistaken belief that prescribed tasks and proffered bonuses are the main incentives to production, will induce the worker to give his best' (1933:29).

The differences were significant. But it is doubtful if they were more fundamental than the differences between Gilbreth and Taylor's successors over stop-watch time study or other schisms within the scientific management church. It is ironic that Gilbreth should have been a particular target of Myers criticism since Myers had more in common with the Anne Shaw tradition of motion study than either of them did with scientific management consultants who placed payment systems at the centre of their activities. It is significant too, perhaps, that when the TUC investigated Bedaux it turned to Myers and the NIIP for advice. Although the TUC was itself increasingly receptive to efficiency systems it still distinguished the human-centred motion study of the NIIP from time and motion studies linked to bonus earnings.

However, it is unlikely that workers with experience of the NIIP distinguished between Myers' motion study and that of Anne Shaw. Myers defined the primary object of movement study as 'to improve those movements of the worker that are necessary to the effective execution of a given operation, and to abolish those that are unnecessary' (1933:78). He emphasised the importance of the workers' natural rhythms, and declared that 'no industrial psychologist would desire to force a worker to one method of work if the latter could demonstrate that another method was better suited to him' (1933:98). Probably Anne Shaw wouldn't have either, but it is not clear how the worker would have demonstrated to either of them that an alternative was better than the method devised by the scientist. Myers cites the following examples of the successful application of industrial psychology. Workers



stalking raisins were taught a new method involving the use of both hands leading to an increase in output of over 11%; a new workbench was provided for workers packing chocolates so that output depended more on rhythm than voluntary decisions; workers in a sweet dipping department were 'instructed to carry out a simple wider circular movement instead of stopping the arm twice and changing the direction of movement'. And in an assignment at a Lancashire coal mine that Taylor would have been proud of, 'The investigators trained the workers to wield the pick (wherever possible) in a continuous curved path' (1933:88-90) .

If sweet dippers and coal miners missed the subtleties of industrial psychology's differences with Taylorism, so did many of their contemporaries<sup>19</sup>. *Cassiers* reported the M. P., Mr T. Shaw, supporting continued funding for the IFRB under the heading *The National Value of Scientific Management* (*Cassiers* March 1921). *Engineering* reported the work of the IFRB at the Derwent Foundry as an application of scientific management, noting in particular that motion study was being used to split jobs into their elements and timing used to eliminate superfluous movement (*Engineering* Oct. 1919). Reporting the work of Charles Myers and others on the subject of fatigue, *Machinery* thought that 'These constitute a distinct branch of scientific management, which, however, can be regarded as apart, although bearing upon such questions as rates of pay, restriction of output and similar matters usually associated with scientific management' (Aug. 1919). *Engineering* made a common connection between the work of the NIIP on employee selection and Taylor's concern to ensure that only first class men were employed (Aug. 1931).

Throughout the 1920s the IFRB conducted a number of studies, some of them under laboratory conditions, some at the request of employers, including Eric

Farmer's work for Manders. The NIIP was more directly involved in the consultancy business and appeared to be moderately successful, increasing fee income from around £1,100 in 1921 to £21,480 in 1931 (*Machinery* April 1927, March 1931). In 1932 the NIIP was called in by Lucas to investigate the position in the tool room, 'to find out the cause of friction there and to report to management' (AEU Reports Oct. 1932). There is no reason however, to quarrel with the general conclusion of McIvor (1987) that the response of British management to the IFRB and NIIP was weak and that their impact was limited. The fact that much, if not all, the work of the IFRB on fatigue, the effects of monotony, rest pauses and incentives were conducted with women workers, suggests a limited scope for its operations.

McIvor accounts for the limited impact by the failure of the IFRB to market its services, the financial costs, low management receptivity and employer cost cutting and preoccupation with economic problems after 1921. But we might add that the very reservations which the industrial psychologists had about Taylorism, particularly incentive schemes, whatever their justification, reduced rather than increased their appeal. The work of the IFRB and the NIIP was criticised as too academic, being described as 'laboratory work by men of laboratory not industrial science' (*Engineering* Jan. 1923). When the IFRB called for their findings to be tried out in industry, *Engineering* disagreed. The IFRB experiments had been carried out by scientists not industrialists. What was needed was an enquiry into the success of Taylor's methods in the United States (*Engineering* Aug. 1924).

## **Conclusion**

Scientific management created new divisions of labour among managers as well as shop floor workers. In this chapter we have seen how the growth of office services



generally, and the of the production engineering function in particular, created new structures of management control, institutionalising the distinction between conception and execution. In the process the engineer became more of a manager and administrator and the foreman a servant of the progress and planning departments now directing production. Evidence of the operation of these new structures of production planning and control is found across a range of industries from the new light engineering and electrical companies to railway workshops and was highly developed in the major car plants of Austin and Morris.

Three important qualifications need to be registered. First, there was no common model to which the new departments or managerial functions conformed. If, in Satchwell's words, the subtleties of production were now to be found in the layout or plan of manufacture rather than in manufacture itself, the actual role and importance of planning departments still varied widely from one company to another. Second, modern structures of production management did not always operate efficiently, as testimony from Willans Works in Rugby shows. Nor, as the example of Marstons shows, did the use of an explicitly Taylorist scheme like Bedaux always signify a developed management structure. And thirdly, development of the new management functions was far from universal. Among the bigger companies, Herberts was probably unusual in leaving vacant its production engineering post for twenty years as an economy measure, but in many small or medium sized companies, such functions will still have been carried out by the directors.

Nevertheless, it is clear that scientific management in the sense of 'the planning and dispatching of operations on the basis of a prearranged time schedule' (Kimball 1927:293) became much more firmly established in the years between the wars.

Turning to the wider management question, the scientific management movement, and its advocates in the Management Research Groups and Institution of Industrial Administration, wielded considerably greater influence by the end of the 1930s.

The founding of the British Institution of Management owed a good deal to the participants in the committee for the sixth international congress for scientific management and its successor, the British Management Council.

Finally, it is clear that there was more to unite industrial psychologists and labour managers with Taylorism than to separate them. The management of the 'human factor' would build on Taylorism, not replace it.



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## Notes

1 This definition, or something close to it, is by far the most common. See for example, Sir William Ashley (1922), 'Scientific management may be defined as the conscious application of directing intelligence to given manufacturing operations'

2 McGuffie (1985:114) seems to think that the system of premium apprenticeship played a role in producing hyper-qualified labour but the system was in decline from the turn of the century and is better seen as part of the crisis of workshop training which employers never satisfactorily solved.

3 Routh (1965:22) says that the proportion of managers does not increase as production methods advance, but figures in table 8 on p23 show the proportion of managers and administrators among all occupational classes growing from 3.43% to 5.53% between 1911 and 1951.

4 Membership of the Institute of Mechanical Engineers grew two and half times to 6346 between 1898 and 1913; membership of eight national engineering institutions reached 40,000 in 1914. By way of comparison, the Society of German Engineers had a membership of 6,900 in 1890

5 By 1923, the office staff were the biggest category, 879 office staff and 659 rate fixers and inspectors

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- 6 Correspondence in *Engineering* detailed complaints of low pay and long hours for war-time 'officials' in the office and demands for trade union protection (Dec. 1918; March, April 1919). In 1922 the National Foremen's Association had 3,400 members; the Amalgamated Managers and Foremen's Association, 3,100 members and the Scottish Foremen's Association had 1,000 members (mss237/3/1/97,1).
- 7 At the GEC plant at Witton, the planning department provided 'an advisory service relieving managers of much of the detailed investigation of organisation and methods and leaving them free to attend to the day to day running of their department' (Gracie 1951:195)
- 8 In his *English Journey*, Priestly (1968:131) described a modern manufacturing plant in these terms, 'You hardly see a sign of active supervision. The foreman class has been nearly eliminated .. Only one or two men in an office know exactly what has happened from beginning to end ... You never seem to see anybody telling anybody else what to do; the places have the dumb secrecy and uncontrolled orderliness of a beehive or ant hill .... (the) human element has been woven into a gigantic system of minute subdivision of labour until the whole place is really an enormous machine in which the workers are simply cogs and levers'
- 9 Calls for the restoration of the authority of supervision whose functions have been taken over by specialists, have been commonplace (Fraser 1952); but they have not been admitted to the ranks of management. Hales' (1982:89) review of research into what managers do defined 'manager' as any job above the level of the foreman .
- 10 Littler (1982) overstates the importance of the survival of sub contracting in relation to the emergence of new managerial methods. In America, scientific management might displace the contractor (Buttrick 1952), but in Britain, in engineering at least, the system was never



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widespread, being 'confined to the machine and stationary steam engine making districts of Northern England, and a few locomotive centres' (Jefferys, M and J. B. Jefferys 1947:41)

11 G. D. H. Cole (1945:357) described the new industries as 'the happy hunting grounds of scientific management and the efficiency engineer'

12 At the Chiswick Works, everything had been done by hand in 1921. By 1928, engine overhaul time had been reduced from 85 hours to 29 hours and 500 skilled engineers had been discharged (Hudson Davies 1928:234).

13 Managers at Rowntree's cocoa works at York included Lyndall Urwick, Oliver Sheldon and C. H. Northcott, and although Sheldon and Northcott are more often associated with wider management ideas, especially the development of the personnel function, all three derived inspiration from F.W. Taylor and practised what they preached at York. Sheldon (1965:35), Rowntree's 'organisation manager' described Taylor as 'the incomparable scientist' and although he endorsed 'grave psychological' objections to the notion of the 'one best way' he argued that "The principles of Taylorism have helped vastly in the task of formulating a science of management ... But they have not in the slightest degree detracted from, and rather, have enhanced, the value of the pre-eminently human capacity of the manager to manage .

14 George Ryder at the Ministry of Labour thought there was so much room for improvement at Manders that even a modified Bedaux system gave extraordinary results (LAB2/2061/IR1441/1938)

15 Grainger (1988a:101) says machinery was still grouped by type, making flow production difficult, in the 1960s.

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- 16 Devinat (1927:83) and Brown (1977:197) are closer to the mark in suggesting that scientific management took the form of industrial psychology.
- 17 Barley (1932) attacked 'unco-ordinated individualism' and advocated a National Advisory Economic Planning Department of government; Urwick (1929:22) was scathing about the obsession with competition
- 18 Sargent Florence (1924) also sought to theorise an alternative to Taylorism based on *The Economics of Fatigue and Unrest* .
- 19 Fenelon (1939) records that research into music while you work by the IHRB found that one steps encouraged a greater output than quick or lively march tunes!



## **Chapter 4    Workers**

### **Introduction**

Chapter three examined changes in the structure of management and the influence of scientific management on management practice between the wars. In this chapter I trace the effects of technical and managerial change on workers using the engineering industry as a case study, and discuss associated managerial strategies and worker responses.

The first part of the chapter discusses the meaning of skill and the reconstitution of the labour process as the management of mechanisation from the office. The emergence of a more highly differentiated workforce is traced in the attempt to adapt the institution of apprenticeship, in the changing composition of the workforce, and in changes to the industry itself. In the second part of the chapter I trace the history of the machine question from the turn of the century to the second world war in order to illustrate employer deskilling strategies, the impact of worker resistance on the shop floor, and trade union attempts to accommodate change by negotiating a grading scheme for engineering workers.

### **Skill and the 'Craft Mode of Production'**

Against an earlier view that changes in the labour process at the turn of the century undermined the labour aristocracy and radicalised the craftsman (Hobsbawm 1976), a considerable body of work now emphasises the continuing heterogeneity of the working class (Reid 1978); the ability of skilled men to retain a grip on their status and functions, especially in industries like shipbuilding (McLelland and Reid 1985); and that despite all the changes in technology, the skill exercised by the craftsman on the eve of the first world war was 'genuine' (More 1980). In

engineering, it has been argued, employers failed to 'break the back of craft regulation' (Zeitlin 1983) and that as late as 1935 'The continued centrality of skilled workers within the division of labour was the basis of the resurgence of workplace militancy' (McKinlay and Zeitlin 1989). As evidence that the 'deskilling pundits' got it wrong Penn cites the numbers of skilled men in the engineering and electrical industries in 1966, and draws attention to the Leyland tool room revolt in 1972 to 'remind us that skilled engineering workers are still very salient' (1983:78).

The first point to make is that differences about the extent of deskilling and the fate of the craftsman depend, in part, on the concept of skill. It is clear that at some points historians with conflicting opinions are simply talking about quite different things. Zeitlin equates craft regulation with job monopolies. For example, he argues that the linotype, which demanded no more skills than those of a typist, was captured by union compositors 'and subsumed under their framework of craft regulation' (1985:288). By contrast, the important point for McGuffie is that 'employers could regulate the actual skills required in the labour process', not who did the actual work (1985:40). It has even been argued that craftsmen successfully defended themselves and were marginalised at the same time. Cook argues that 'Using their existing skill based workplace power, craftsmen, through "assertive co-operation" ensure their own future importance. An additional point is that industrial craftsmanship has become peripheralised (e.g. maintenance electricians and toolmakers' (1988).

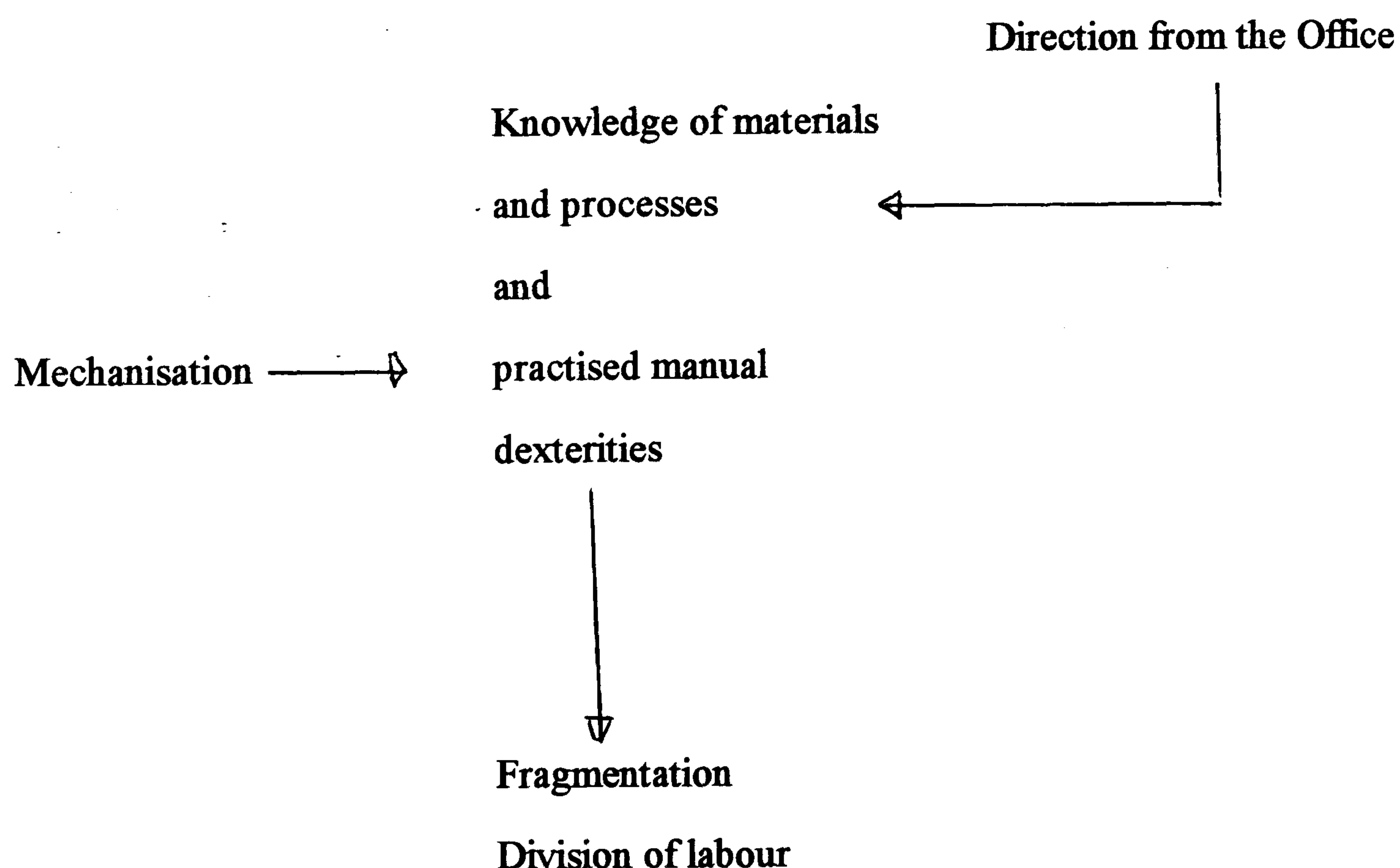
Many of the different ways of defining 'craft' and 'skill' were reviewed by William Form (1987) without finding any significant measure of agreement among the authors who had written on the subject. The definition of craft skill adopted in this study is that offered by Braverman, namely, 'the combination of knowledge of



materials and processes with the practised manual dexterities required to carry on a specific branch of production' (1974:443). Like all definitions it can be stretched this way and that to cover different degrees of knowledge and manual dexterity that are, in reality, qualitatively different things. But it has the virtue of identifying clearly enough the key constituents of knowledge and practice in a way that accurately reflects opinion on the question in the period under discussion. C. G. Renold, for example, defined skill as 'knowledge, dexterity, power of decision and judgement in combination' (Renold 1929:157).

This idea of craft skill together with the processes which were undermining it, is represented in the diagram below

**Figure 2      The Decomposition of Skill**



Formal definitions, however, do not get us very far. More's definition of skill as 'some combination of manual skill and knowledge, not necessarily very considerable, which is useful to industry' (1980:16) contains the same key elements identified by Braverman, but might be applied equally to the 19th century millwright and the 20th century radial arm driller. We could distinguish the millwright and the driller by deciding *how* useful or considerable their manual skills and knowledge were, but this only distinguishes degrees of skill and does not reveal the qualitative nature of the change in the work of the craftsman. More's view that engineering craftsmen exercised genuine skill before the first world war depends, as he acknowledges, on a static view of skill seen as 'useful attributes' and largely measured by training times.

For Braverman, knowledge of materials and processes is the really critical element which enables the craftsman to exercise a substantial degree of control within the labour process. But, here too, it is important to emphasise that there are degrees of skill. Typically, the labour process at the turn of the century has been analysed as a transition from craft to class, from craft production to mass production. There is some question however, whether it is accurate to speak of a 'craft mode of production' or 'craft control' as characteristic of the labour process at the end of the 19th century. McGuffie has argued, convincingly enough, that the material basis of the crafts had been broken up long before the advance of mechanisation, that employers had achieved a degree of control and regulation of skill much earlier. The millwright's craft for example, was fragmented into specialities, principally that of fitter and turner. Millwrights themselves formed a constantly shrinking number of all 'engine and machine makers', from a little over 27% in 1841 to a little under 14% in 1861 (Jones 1976:49). As Berg (1979) has shown, skilled men fought a continuous battle against subordination to the capitalist labour process throughout



the 19th century. But by 1900, in engineering at least, direct employment and payment through the office was common and work was under the 'control' of works managers and their foremen.

Changes in the labour process in the early 20th century were, therefore, clearly part of a longer, more continuous process. If the turner at the beginning of the 1890s was a craftsman, he was not the craftsman he had once been (Burgess 1969, 1975). At the same time, if by the 1930s there was little left of 19th century craftsmanship for the turner in a modern works, he might nevertheless remain *more* skilled than the driller, not only in More's sense of the term but in Braverman's too. The really important question is whether the changes at the turn of the century amount to more than a matter of degree, whether they constitute a critical moment of discontinuity in which the labour process is reconstituted more directly under management control. In the following section it is argued that such a qualitative change did occur as a result of the management, from the office, of mechanisation. Taking all the qualifications as read, the change might still be usefully described as a shift from craft-type skill based on knowledge, to skill as a measure of defined competence. The key point is that attention should not be confined simply to divisions within the ranks of the workers but to see those divisions, and understand their meaning, in the context of the labour process as a whole; to see changes on the shop floor alongside a change in the structure of management control emerging from the office.

### **The Reconstitution of the Labour Process**

Contemporary views on skill were near enough unanimous. The day of the skilled worker would soon be over, thought *The Engineer* in 1892 (July 1892). An exhibition of handicraft skill put on by the London Trades Council in 1893

prompted *Engineering* to reflect on the advance of the division of labour and to wonder whether pride in union might not replace pride in craft as a motivator of men (July 1893). Although America was more advanced than Europe, wrote one observer in 1896, 'The days of the good 'all-round' mechanic are numbered, partly because there is little or no demand for his skill and labour' (Grimshaw 1896:532). In fact demand for his labour held up rather well in Britain. A more perceptive comment noted that the modern worker was a product of a changing production system, 'the skilled workman of today is as much a product of the times as the machines he is so largely occupied in tending ..... this machine-made workman, the ultimate product of the system of specialising the man to the work (Wansborough 1896:256,258). It was usually, but not always, the skilled man who was the object of such attention. The signal triumph of improved machinery and better administrative methods, wrote Francis Richards, was the utilisation of a vast resource which had previously been wasted, 'the energy of the unskilled masses' (1900:518). All discussion pointed to a more highly differentiated work force and one in which thinking would become the preserve of the few. There was still a need for hand skill in the industry, argued *Engineering*, but nine tenths of ordinary operatives needed only manual dexterity, 'It is not necessary .... that the man who loads stone into the cart should know the geological order to which the stone belongs' (April 1901).

It is significant therefore that much of the comment on skill stresses the growing split between thinking and doing, between mental and manual labour. 'On all hands science is working to reduce skill, not to increase it', wrote *The Engineer*, 'and whilst we are adding enormously to mental ability at one end of the scale we are reducing at the other the value of manual dexterity' (Oct. 1909). Much of the discussion in Britain still had a technological bias. It was the development of



machinery which was seen as the driving force of deskilling. But there was a clear understanding that machinery and management, mental and manual labour, were all bound up together. In a well staffed and well organised shop, argued *Engineering*, 'all round skill in manual workers is now of minor importance, because the all round knowledge of the directional staff enables most of the manual work to be done by men of a rapidly acquired single skill'. Specialisation and subdivision of work was nothing new. What was different now was the conscious pursuit of these processes as an end in itself, 'the difficulties that individual workmen had formerly to overcome for themselves are being taken away from them and grouped, to be dealt with by others who have no other function' (March 1918).

Alfred Herbert's contrast of machine tools and workshop methods in 1919 with those of an earlier period pinpoints the critical shift in control.

In those earlier days the amount of work done in the drawing office was much less than is customary today. Now the drawing office is looked upon not only as the "designing" department, but as the "thinking" department. In earlier days, the drawing office was called upon simply to produce designs; but the necessary detail involved in the carrying out of those designs was left very largely to the knowledge and memory of the foremen and principal workmen, guided by tradition of previous similar work. When new machines were introduced, detailed drawings of the most troublesome parts were, it is true, prepared, but very usually machines with which the shop floor had become familiar were built from the most sketchy tracings on a scale of 1.5 inches to the foot. The amount of information given on the drawings was extraordinarily meagre; gear

wheels, for instance, being indicated merely by red circles with a note as to the number of teeth and pitch. The various classes of fits required were left entirely to the judgement of the works (1919:283).

At Herberts a large proportion of the production workforce continued to be classified as skilled but it is unlikely that such a classification was wholly accurate. Between the wars Herberts ran a 'vast apprenticeship system' with apprentices on piecework from day one, with the quality of training dependent on family connections and persistence as much as ability. And Herbert's management was willing to 'debunk the myth of Herbert "craftsmanship" when it suited their purpose' (Grainger 1988:105, 201). Where production engineering was more developed, change was more radical. 'The turner was no longer given a piece of steel and told to "make another like one like this", but the machinist was given a part-section drawing and a finished batch of work from the presses or foundry, performed his operation, had it inspected and passed it on to the miller or driller' (Jefferys 1945:203). McKinlay cites the North West Engineering Trades Employers Association opinion that only a third of post-war fitters performed work as complex as their pre-war counterparts, and the AEU to the effect that only 30% of turners exercised any wide discretion when working from drawings (1986:131,136).

McKinlay's argument that Clydeside employers did not attempt to 'redraw the engineering division of labour' but to 'redefine the boundary between skilled and non skilled work' seems to be a fine distinction. At best it describes only what was happening at one end of the labour process. The redrawing of the engineering division of labour involved more than the question of who worked on a given



machine and at what rate of pay. Much of the work now done by fitters and turners was skilled only in the sense that it required training and judgement not required of other workers. It was no longer a process conducted by craftsmen but one increasingly determined in the office and executed on the shop floor.

The redrawing of the engineering division of labour created a more highly differentiated workforce. Formerly unskilled labourers, for whom work at a capstan lathe or a milling machine may have been experienced as an upgrading of labour, now worked alongside men still described as craftsmen, but whose actual work was only superficially related to that of a previous era. 'The general result', Edward Cadbury told G. C. Renold, 'will be a class of semi-skilled workers, whose work will be highly specialised and monotonous, and which demands little or no initiative, since thinking and initiative are the function of management. We must remember that the trained skill and initiative which distinguishes an artisan from an unskilled labourer has a money value, and under Scientific Management this capital passes away from the workman to the management' (1914).

The really skilled man, Renold replied, would move on to inspection, machine setting, time study and new opportunities in the drawing office, production control and the toolroom. If the personal experience of the skilled individual reduced to machine minding was degrading, the social process, he argued, was not nearly so dismal. *Machinery* was similarly convinced that the skilled man would be displaced onto more demanding work (April 1922). Craftsmanship had not been destroyed, 'It is merely transferred from the many to the few'; in particular it had been transferred 'to the engineer and the trained Executive while the workman is free to specialise and become skilled in his own sphere' (Aug. 1930).

There was truth in this, though the elevation of the few was small comfort for the many. But whether or not the optimism of Renold and *Machinery* was justified, the displacement of skill to the office further underlines the changing nature of the labour process. At Metropolitan Vickers there was 'a continuous migration of qualified trade apprentices to junior positions in the drawing offices, testing departments, and to rate fixing, inspection, and assistant foremen positions' (Fleming 1937). An analysis of 493 apprentices completing a five year apprenticeship at Metropolitan Vickers in the late 1930s produced the following information about destinations

**Table 2      Apprentice Destinations, Metropolitan Vickers 1937**

Type of Employment on completion of Apprenticeship	Entrants Elementary Schools %	Central Schools %	Secondary Schools %	Junior Technical Schools %
Craft work on bench or machine	74.5	40	23	10
Test Hands	7	7	18	28
Works Staff, Production, Processing	5	7	9	14
Drawing Office and Design	13	43	46	45
Commercial Departments	5	3	4	3
All types of post Apprenticeship Employment	100	100	100	100

Source: Fleming 1937



In 1935-36, 26% of the apprentice intake had come from Junior Technical Schools and 23% from Central and Secondary Schools, so the leakage into the office was significant, so much so that in 1937 Metropolitan Vickers limited admission to trade apprenticeship to youths leaving elementary school at the age of 14. Nor was their experience unique. Responding to Fleming's paper, Mr ES Byng reported that at his firm, of a batch of 200 boys, 70 had left the company and only 10 of the 130 had remained as craftsmen. Few boys, observed another participant, A. E. Berriman, wanted to remain as tradesmen.

Writing in 1929 GDH Cole also underlined the displacement of skill and its consequences for work and the workers. After the war industry had reverted to pre-war practices but mass production methods were spreading, he argued, from one industry to another.

The consequence has been that, although the words "Scientific Management" are no longer often used, the worker finds himself a great deal more managed in his job than in pre-war days. More and more the machine sets the pace, and he has to conform to it. More and more the machine determines precisely how the job is to be done, and converts the man into a fellow-automaton bound to its service .....

.... more and more workers will pass under the new discipline of industry. They will have less control than of old over the method of performing their jobs, less control over the pace at which they work, less to think about beyond the sustained attention and strain

involved in keeping on slogging away. They will need less skill and more slickness, less specialised training and more drill (1929:95,98)

Cole was particularly worried that, as the 'logic of the machine overtook the craftsman', trade unionism, which drew strength from the common bonds of craft, would be weakened until built on new foundations. Even then the hold of trade unionism on the worker's mind would probably be permanently weakened since the 'new technique of industry will put far less distinctive marks on the worker's personality than the old craft system' (1929:101). The new worker would be more instrumental in his attitude to work, more politically than industrially minded.

Cole was at least partly mistaken on both counts. First, the 'craftsman' lasted longer than the material basis of his craft, even enjoying the sort of revival which Hobsbawm described as a 'last triumph of the Victorian trades' in the late 1930s (1984:269)<sup>1</sup>. More importantly, in the longer run, craft unionism adapted itself to the new conditions. Always a sectional interest within the wider working class, 'craft unionism' continued to be effective where it was a vehicle for establishing the sort of job monopolies and job controls which the new layers of semi-skilled workers eventually established for themselves, or where it succeeded in building a wider base of support in common action with the new workers.

The latter built their own trade unionism and one which eventually succeeded in establishing job controls which could be as extensive as those once established by craftsmen. They did so in response to their own class and industrial predicaments (Lyddon 1983), and not through a diffusion of craft controls (Zeitlin 1980).

Among the characteristics of 'craft' discussed by Scullion and Edwards, the notion of the autonomous workman, of the ability to sell abilities to employers which are



then exercised without close supervision, must carry considerable weight (1988:119). Few manual workers could claim such autonomy on the basis of their craft knowledge, status, or position, by the late 1930s. The late triumph of the Victorian trades owed more to trade union action in a tight labour market than anything derived from the remnants of craft.

### **Apprenticeship and Training**

The survival of apprenticeship as the principal form of skill training might be taken to suggest that the extent of deskilling was limited. In fact, increasing specialisation, narrower training, and the growth of piecework, all indicate the 'increasing proletarianisation of the apprentice' before 1914 (Knox 1986:174). The essential problem was the need for a more highly differentiated system capable of producing engineering managers and new categories of office staff, men with craft-type skills, 'skilled' men and machinists of all kinds. Since the sort of elaborate training system built up in Germany was criticised on all sides and rejected (*The Engineer* Dec. 1890; Orcutt 1902), there were attempts to remodel the institution of apprenticeship to meet new needs. The North East Coast Engineers proposed a two-tier training system which would distinguish between tradesmen and 'those destined to work in the higher branches of engineering and shipbuilding' (*The Engineer* Jan. 1904). Similarly, in government ordnance works, two distinct training courses were to be available, one for 'upper managerial staff' and the other for 'trade lads' (*The Engineer* March 1905). The attempt was largely unsuccessful but an examination of apprenticeship and training serves to illustrate the ways in which skilled work was being reconstructed.

A series of reports on apprenticeship in *The Engineer* in 1907-09 revealed attempts to differentiate among the 'trade lads' at the more advanced firms. At Clayton and

Shuttleworth in Lincoln in 1907, a new apprenticeship system divided boys into eight separate trades, with no movement between them. The firm did however promise that 'keeping a boy for months on routine work, simply because he has become skilful at it, will so far as possible be avoided' (Feb. 1907). At the British Westinghouse Company in Trafford Park there were three grades of apprentice with the trade apprentices largely confined to one department (Jan. 1908). At W. H. Allen of Bedford, one of the few firms to retain premium pupils, those of the artisan class who did well in evening classes had 'the privilege of spending six months of the last year of his apprenticeship in another department of the works in which he has not been apprenticed' (Feb. 1908). Similarly, at Mirrlees Watson apprentices remained 'in the branch of trade at which they commence' unless they demonstrated a serious attempt to improve their knowledge (May 1908). Three categories of apprentice based on age and qualifications at entry was common and it was also common enough for the lowest grade of apprentice to remain in one shop during the whole of their apprenticeship as they did at the Midland Railway Company (April 1909). The system of indentured apprenticeship was being replaced everywhere by informal or simple written agreements, a new apprenticeship which was not one institution but many.

Employers continued to rely on skilled labour of the craft-type where technology was still relatively primitive, where production management was underdeveloped, and for reasons of 'business rationality' (Hobsbawm 1984:253). All three circumstances were present before 1914, but all were changing. Apprenticeship failed to keep pace. 'Our enquiries have to a great extent been disappointing', wrote *The Engineer* of its apprenticeship survey. 'We had imagined there was some real general upward movement in the training of apprentices, but we are constrained to admit that with the exception of quite a few firms, the old indifferent system of



training-by-hazard, which came in when the factory system killed the 'master' and the home workshop, still obtains' (Jan. 1908a). The coincidence of deskilling and widespread concern about training was, of course, entirely consistent. At the Baldwin Locomotive works in the USA, where a skilled man was taken to mean 'one who is familiar with the use of a tool, a machine, or a process', a new apprenticeship scheme was instituted because 'the general mechanic has threatened to become practically extinct to the detriment of the manufacturing interest generally' (Converse 1902). There were concerns about the quality of off-the-job training for future managers but a greater fear that increasing specialisation and the decline of apprenticeship would rob industry of the craftsmen it still needed. 'It is more than ever important therefore', wrote *Machinery*, 'to readjust the methods of training artisans to suit the requirements of modern industry' (Nov. 1914).

Education was commonly urged as a necessary antidote to the monotony and mind numbing routines of modern work (Cadbury 1912:20). It was necessary, argued *The Engineer*, to replace the intelligence which had been a by-product of apprenticeship (Dec. 1905). Many of the 'trade lads' were now learning a single operation, a system which resulted 'in the production of youths and men with stunted and limited intellects - the very thing which the manager most dreads' (Feb. 1906). Following a conference on apprenticeship in 1909, *The Engineer* noted bitterly that 'when we discuss the technical training of boys and girls, we absolutely must not lose sight of the fact that, whilst on the one hand we talk of improving their intelligence, we are on the other tacitly degrading it'. The process of modern manufacturing depended for its success 'upon the degradation of the intelligence of the operator' (Dec. 1909)<sup>2</sup>.

War-time production underlined the difference between teaching and learning in skill training. Apprentices learned to flat file in about a year, reported *Engineering*, but women could be *taught* to flat file in a tenth of that time (March 1917). It also underlined the demand for differentiated training to meet different demands for skill. 'The functions of the engineer and the craftsman are entirely different', argued Michael Longridge in his address to the Institute of Mechanical Engineers in 1917, 'and their training must be different also. Moreover, differentiation is needed in the training of the various classes of engineers and workmen' (1917:412). When the Ministry of Labour reported on apprenticeship and training in 1928, it was *Engineering* that asked the key question - what training was needed and for whom? No reform could be effective 'until means are provided for defining the intended skill more accurately than is the case at present' (July 1928). In some cases training was being wasted, in other cases it was insufficient. In the mid thirties, some production engineers were complaining of the tendency for men 'who have had the necessary training for craftsmanship to get absorbed in the manufacturing departments, where much of their early training is wasted'. Others were more concerned with the difficulty of obtaining first-class toolroom men, 'the direct result of allowing the previous generation of super-skilled mechanics to die out' (*Proceedings*, Production Engineers 1934-35). No systematic solution to the training problem was ever attempted however. Some firms tried to adapt apprenticeship to provide for such differentiation. Elsewhere the system produced uncertain and highly variable results.

The lack of clearly defined purpose in training made it possible, *Engineering* argued, for the 'vicious practice' of counting work turned out on automatic machines as skilled. There was a similar implication in the reaction of *The Engineer* to the Ministry's report. Employer satisfaction with existing training levels, despite



the report's findings that insufficient boys were being trained, was explained by the fact that 'in many cases the standard of skill is so low that no previous training of any kind is required, and that satisfaction with the present system indicates a falling off in the general all round quality of workshop labour' (Aug. 1928).

Training also took place outside apprenticeship. The EEF, while in favour of some form of apprenticeship, thought 'alternative methods of training may be adopted as the development of the industry may require'. The EEF's committee on the supply and training of apprentices found that 'large numbers of boys and youths, not apprenticed, are learning skilled work and eventually taking their places in the skilled categories in the same way as apprentices' (EEF Minutes March 1928).

Fewer apprentices were trained in the larger companies, it was the smaller firms where the bulk of apprentices were trained. Indeed, McKinlay suggests that apprenticeship more or less disappeared from the mass production industries in the 1920s and that where there was apprenticeship training in engineering, its content was solely determined by the needs of individual firms (1991:100).

The connection between this sort of apprenticeship and its craft history was increasingly remote. From one side, semi and unskilled labour was being trained to operate a range of new machinery, some of them eventually 'taking their place in the skilled categories'. From the other side, skilled men engaged in the 'vicious practice' of claiming skilled status on semi-skilled work. Nor was there a defined threshold of skill dividing one kind of work from another. It is no longer appropriate to speak in terms of 'craft' in this situation. However, the failure to substitute some other, more systematic, form of training for apprenticeship had wider implications. The association of skill and apprenticeship remained strong and reinforced the claim of time-served men to work of a particular kind.

The concept of 'socially constructed skill' might have been a useful way of understanding how archaic structures like apprenticeship helped to perpetuate patterns of occupation and pay where the conditions which once justified them had disappeared. But, in the first place, all skill is socially constructed to one degree or another, though the technical, material base of such skills may be stronger or weaker. Secondly, the idea has been used to suggest that genuine skill was created as a consequence of employers adapting technology to suit. There may be isolated examples of this but there is no evidence, despite widespread propaganda about workers' restrictive practices, that the defence of skill has been a serious determinant of the mode of production<sup>3</sup>. With few exceptions the struggle around skill has been about pay and jobs, little different in substance from the struggle of other workers. The idea of 'socially constructed skill' can obscure rather than illustrate the fact that such a social construction is necessary precisely because deskilling has taken place. In some ways the question boils down to whether skilled workers who have secured skilled pay and status on deskilled work have been deskilled or not? The argument does not seem worth pursuing in these terms. The answer must be that they have been deskilled but they have secured, even if only for a time, compensating advantages which are important in their own right.

### **Occupational Change in Engineering**

The outstanding feature of occupational change in engineering in the first half of the 20th century was the growth in the numbers designated as semi-skilled. 'During the last ten years', the EEF noted in 1934, 'the semi-skilled class in the engineering and allied trades has increased greatly in number and importance. Particularly in machine operations the semi-skilled man has assumed a status, while it does not rank with that of the tradesman, is of such importance that it can be said to emulate



the tradesman, and in many establishments his earnings are greater than those of the tradesman' (EEF Minutes Nov. 1934).

Figures for the changing proportions of skilled, semi and unskilled engineering workers can be found in the records of the EEF. Such figures clearly have their limitations. They do not measure the more fundamental change in the position of the craft worker consequent upon new ways of organising and directing production. Moreover, they are compiled from returns made by employers who had not adopted any common standard by which to judge skill, and were presumably based on the numbers that were paid the skilled rate. And as we shall see, the rate paid for the same work varied from one establishment to another according to the judgement of the employer and the success of the employees in influencing such judgements. They may nevertheless reflect underlying processes sufficient to tell us something about the direction of change.

**Table 3 Skill Composition of the Engineering Workforce, 1914-33**

	Skilled %	Semi-skilled %	Unskilled %
1914	60	20	20
1921	50	30	20
1926	40	45	15
1933	32	57	11

Jefferys (1945:207)

Yates (1937:32)

On these figures, the changing of places of the skilled and semi-skilled could not be clearer. And Jefferys provides supporting evidence in the form of an analysis of new entrants to the AEU showing the proportion of turners stationary at around 13%, and the proportion of machinists and others rising from 30% at the beginning of the 1920s to 45% before the war. Over the same period membership of the skilled sections of the union fell from 75% of the total to just over a half, and 'the proportion of total entrants to these sections had decreased from approximately one half in the early 'twenties to just below one fifth in the late 'thirties' (1945:208).

If the figures for men only are taken, the rate of change in skill composition slows significantly



**Table 4 Skill Composition in Engineering - Adult Males 1914-34**

	Skilled %	Semi-skilled %	Unskilled %
1914	58	21	21
1921	50	29	22
1931	42	44	14
1934	41	47	13

Source eef/237/13/3

These figures do however, indicate a similar trend and may well overstate the numbers of skilled<sup>4</sup>. *Engineering* noted in 1924 that an apparent increase of 20% in the numbers of skilled men was 'due to a process of dilution rather than any increase in ability'. Semi-skilled operators on automatic machinery were being classified as skilled on account of the their rate of wages (Sept. 1924).

Another way of looking at the industry is to note the shifts in geographical location and industrial sector. The inter-war period saw a decisive shift in the location of the industry to the Midlands and the South, the areas where the newer industries were growing fastest. The percentage of the workforce employed by companies affiliated to the EEF in Birmingham, Coventry and London, rose from around 40% of the total before the first world war to more than 55% by 1939. By 1935 more than half of all engineering workers were employed in electrical engineering or the motor, cycle and aircraft industries. In 1935, 65% of engineering workers in the London area were employed in motor vehicles or electrical engineering. The corresponding figure for the Midlands was 83% but for Lancashire and Yorkshire only 33% (Jefferys 1945:199). As early as 1933, over 48% of the EEF's wage bill was

accounted for in Birmingham, Coventry and London, compared with less than half that amount in the North East, the North West, Manchester and Sheffield combined (eef/237/13/3/28-30).

The Midlands and London employed a much higher proportion of women, and more of every kind of labour on piecework than engineering centres in the north.

**Table 5 Employment of women in Engineering and the numbers of all workers on piecework in 1931 - by Area**

	% of Women employees	% of all classes PBR
Birmingham	22	68
Coventry	16	75
London	21	53
Manchester	11	58
North East	4	37
North West	2	36
Sheffield	3	35

Source eef/237/13/3/5 and 22

James Hinton notes that the proportion of semi-skilled workers in general engineering in Coventry in 1914 was already very high and that 'the traditional aristocracy, whose wartime trauma underlay the emergence of the movement in the engineering centres of the North, hardly existed in Coventry or Birmingham' (1973:218)<sup>5</sup>. If those workers emerge as 'skilled' after the second world war, it is not because the labour process was re-skilled.



A further clue to the restructuring of the engineering workforce from the turn of the century is the fate of the 'machinemen'. Sometimes classified together, sometimes detailed separately, the machinemen included all the new machine trades from drillers, millers and grinders to turret and capstan lathe operators and borers. Some were regarded as skilled - about 25% according to a rough division by the EEF. In 1924 the ratio of men to apprentices for a number of trades was as follows

**Table 6 Ratio of Apprentices to Journeymen 1924**

	Men	Apprentices	Ratio:1
Fitters/Erectors	43849	20030	2.19
Turners	21364	8465	2.52
Sheet Metal Workers	4523	974	4.64
Joiners	2752	476	5.78
Machinemen	34078	5778	5.90
Welders	229	32	7.16

Source eef/237/13/3/6

The difficulty with the category of 'machineman' is that it stretches all the way from the turner to the handyman-labourer. In that sense it ought to serve as a definition of semi-skilled but the problem of arbitrary classification of individuals and jobs is at its most dangerous here. In 1924 the Industrial Court refused the skilled rate for two time-served turners because they had taken work turning axles below the skilled rate and on work which did not require their craft skill. At the same time five machinists, two of whom had served apprenticeships as turners, one as a miller

and one as a machineman, all received the skilled rate because they had skill 'commensurate with that of the fitter/turner' (AEU Aug. 1924). In all likelihood, the machinists will have been classified as skilled and the turners as semi-skilled, for the purposes of the Federation's statistics.

In 1897 James Nasmith told the Manchester Association of Engineers that 'One direct consequence of the adoption of the newer methods and appliances was such a subdivision of some operations as to involve a fresh organisation of labour, and in this way there had been silently worked a revolution which was not always fully appreciated even yet' (*The Engineer* Jan. 1897:71). At Armstrong Whitworth that silent revolution had produced a pre first world war workforce in which fitters and turners had given way to machinists

**Table 7 Categories of Employees at Armstrong Whitworth in 1913**

Machinemen	1316
Fitters	1261
Apprentices	706
Handymen and Labourers	631
Machinists (girls)	119
Turners	396

Source eef/237/3/1/205

This may be an extreme example. In any case it is important to remember that the category of machineman covered a shifting group of occupations so no figures relating to machinemen should be taken too literally. Nevertheless, it seems clear



that by the 1930s, as an occupational group, machinemen were twice as important as turners and not far off the numbers of fitters. In 1931, for example, there were 40,266 fitters, 16,716 turners and 33,710 machinemen (eef/237/13/3/22). The big companies, particularly in the motor industry, all had large numbers of machinemen; almost a thousand at the Austin in Birmingham, 740 at Morris and 1,045 at Metropolitan Vickers in Manchester.

The term disappears from the records in the 1930s by which time some of the machinemen have been classed as semi-skilled but others, as the 'machine question' rumbled on through the inter-war years, will have been paid the skilled rate and classed as skilled.

### **The Craft Union and the Machine Question**

As engineers distinguished themselves from 'mere mechanics', and craftsmen fought to distinguish themselves from machinemen, the status of the craft union underwent a profound change. For much of the 1890s engineering journals continued to sing the praises of the 'old unionism'. *The Engineer* still had confidence in the members and officers of 'guilds of highly skilled labour' such as the ASE. Unlike the unskilled unions whose members 'lacked intelligence' and whose leaders were only leaders for the hour, the skilled men could be expected to conduct their affairs honourably (Jan. 1890). *Engineering* described the ASE as 'an industrial army of trained and skilled men, of whom any nation might well be proud' (July 1891). A report the following year described the ASE as 'a union of self helpers, by mutual effort and mutual aid ... a credit to itself, and to the great engineering industry with which it is connected' (Sept. 1892). As late as 1896 this 'self supporting working men's association' was admired for its unemployed and Superannuation benefits which kept 10,000 heads of families off the rates (May 1896).

The engineering lock out, and the struggle which led up to it, radically changed these perceptions of the ASE, and no journal ever referred to the union in such glowing terms again. The search for an explanation for the ASE's fall from grace began with the rediscovery of trade unionism among the old unionists. *Engineering* now thought 'old unionism' owed its reputation to the softening effects of time, that the ASE was the same as it was fifty years ago. 'In 1851 they snatched at the prize, and missed it, and the same thing has happened again' (Dec. 1897). More commonly the union's stand in the dispute was attributed to the spread of socialism; a pact, as Colonel Dyer put it, between the advanced socialism of Tom Mann and the new unionism of George Barnes (Dyer 1897). *The Engineer* went so far as to identify the influence of the socialist, Prince Kropotkin (sic)! But, whether explanations were sought in traditions of the past or the politics of the present, the critical underlying issue in the dispute was the 'machine question', and linked to it, the whole character of the labour process and the place of skilled men within it. Not even an extended period of social peace could restore the ASE's reputation. The basis on which the union had built its formidable presence, its reputation and its respectability, was under siege. The revolution in methods of production, argued *The Engineer*, had made the ASE an anachronism, a fossil (Jan. 1898).

The view of craft unionism as an anachronism came to be shared by at least a section of the engineering workers themselves. In the district committees and in the workshops, the 'guerrilla war' which *Engineering* predicted would follow the ASE's defeat in open battle, broke out almost as soon as the return to work had taken place. But, ironically given the outbursts about the evils of socialism, it was the socialists who quickly accepted that craft unionism could neither unite the workers nor protect the craftsman. The leaders on the Clyde tried to conduct the



struggles around dilution as a struggle for workers control and nationalisation (Hinton 1971) while activists on the left, and officials at the head of the organisation, sought to open up the AEU to membership for the semi and unskilled. From Tyneside Tom Gillinder (1920) wrote about 'the trend of changed methods of production under scientific management' to argue against the craft outlook and for 'the spirit of progressive unionism, void of the purely conservative idea of maintaining the craft to the exclusion of the logic of mechanical and industrial progress'. The next generation of the AEU's leadership entered the lists for industrial unionism. 'Our lives are at stake', wrote Jack Tanner, in 1925, arguing that an industrial union 'must not be held back any longer by ancient traditions' (1925)<sup>6</sup>. In July 1926 the editor of the AEU journal called on all members to make the new industrial section work, and in October he told his readers, 'Standardisation and mass production wherever it can be introduced is the order of the day, and these new methods of manufacture are making interchangeability of work more possible - teaching us that the interest of all workers is identical' (Oct. 1926).

For the most part, however, such appeals fell on deaf ears. As membership of the AEU fell 30% following the lock out in 1922, the craftsmen retreated to strongholds of skill like the tool room and fought a rearguard action 'to preserve as much work as possible for members of the craft' (Cole 1945:354). All attempts to extend the membership foundered on the sort of attitude expressed by A. J. McKee in a letter to the union journal, rejecting 'any suggestion that craft unions should be submerged into an unskilled, unworkable and dissatisfied mass' (AEU May 1924). It was not until 1937 that the numbers of semi-skilled exceeded the numbers of skilled members (Carr 1979:257). But if Jack Tanner failed to establish the AEU as an industrial union, A. J. McKee couldn't defend his disappearing craft either. The

result was a messy compromise, an industrial amalgam of upgraded machinemen and downgraded craftsmen, where skilled and semi-skilled production workers were distinguished by the rate of pay agreed for a given job, and skilled men on time work by their inability to match the earnings of production workers, whether skilled or semi-skilled.

### **Guerrilla War in the Workshops**

The 'guerrilla war' in the workshops following the unions' defeat in 1897 was soon underway. In 1898 the EEF was discussing a strike on the machine question in Halifax and 'encroachments' on the terms of settlement in Newcastle and Bradford (EEF Minutes Oct. 1898). In Hull, in 1900, an overtime ban was withdrawn after an unskilled man was taken off a capstan lathe; strike action was threatened, and then withdrawn, in Bolton over the employment of unskilled men on 'machine tools' (EEF Minutes Jan., Oct. 1900). In May 1900 a strike broke out at Boddens in Oldham when a semi-skilled men was put on a turret lathe and continued through June (EEF Minutes May, Aug. 1900). The Emergency Committee of the EEF reports at least one strike on the machine question in every year between the turn of the century and 1913, except 1903. In 1904 a strike followed dismissals after alleged intimidation of machinemen; a hundred men were out for four days in Hull in 1905 when machinemen were put on horizontal boring, drilling and milling operations. In Burnley in 1907, one hundred and eight men were out for ten days trying to remove 'handymen' from lathes. Between 1911 and 1913 the number of disputes on the 'machine question' accelerated significantly. In 1912 a strike in Blackburn led to the use of strike breakers and an alleged threat of an attack on the factory, with police reportedly advising the factory owner, Mr Henry Livesey, 'that his family would be better to leave their home for a time' (eef/237/1/160). And, in 1913, the EEF Emergency Committee complained that, 'In several districts



questions regarding the manning of machines were raised by the unions, and from the circumstances present and the nature of the demand in each case it rather appeared as if the movement was the result of a pre-arranged plan' (EEF Minutes Feb. 1913).

The ASE put forward its proposals for dealing with the machine question in 1897, before the lock out. Notwithstanding their claim to work any machine made or used by the engineering trade, the ASE offered to establish joint committees with the EEF, with representation from the Board of Trade, to which disputes about the wages to be paid on any machine could be referred. The committee would determine a rate which would be more or less than the fitters' or the turners' rate, 'having regard to the class of machine and the quality of the work' (eef/237/1/160). Clearly the ASE representatives on any such committees could be expected to demand the skilled rate on almost all jobs. But three things should be noted. First, the ASE proposed to 'follow the machine' by defining a rate for the job. The question of defending a 'craft mode of production' or any form of organisation of production or division of labour did not enter into it. Secondly, the position of the ASE in 1897 was substantially in line with that of the EEF. The employers' policy was to pay a rate which reflected 'the skill of the operator, the work being done and machine being worked', a formula which the unions formally acknowledged in 1929 (EEF Minutes Oct. 1929). And thirdly, the ASE's position in 1897 was not simply a manoeuvre for position in the coming struggle. Over a period of fifty years the unions developed their demand to negotiate a grading of labour scheme to reflect changes in the nature of the work being done. What divided unions from employers over the entire period, on this issue, apart from the obvious conflict over the price of labour, was the employers' refusal to negotiate. The consequence was that bargaining of one kind or another was driven down to the shop floor where the

changing nature of the work demanded a continuous stream of judgements and decisions about machine staffing and pay. The EEF contributed much more significantly to the development of a tradition of shop floor representation and bargaining in engineering than any craft tradition did.

On the shop floor conflict was shaped by the immediate pressures and opportunities of the struggle. There were strikes to remove handymen and machine men from tools claimed by fitters and turners as well as conflicts over the rate for the job. The ASE did not claim work on 'fully automatic machines', but the definition of a semi-automatic was a broad one including any lathe that required 'pulling round from time to time, every time the screw is finished and cut off, the bar slackened off by hand and pulled out to make the next length' (eef/237/1/160). And at the Vulcan Motor and Engineering Co. in 1913, the ASE objected to a driller being placed on a vertical boring machine which had been installed by a turner. The employer argued that it was a fully automatic machine and the union would have had no objection if it had been installed by the manufacturer rather than the company's own man, but the union took the view that, once a skilled man had been put on the job, it was skilled work (eef/237/1/160). The EEF was just as ready to seize any opportunity to further its own interests. The Chair of the Special Conference on the machine question told the unions in 1912, 'You say that a Gisholt lathe is a turret lathe and therefore a skilled man ought to work it. That is what you say, but we are saying instead of that - to put it very coldly - if a handyman can do the work up to specification, well, we let him do it' (eef/237/1/160).

Much has been made of the success of engineering workers on the machine question in the years before the first world war. A contemporary account making a



similar claim was given in a paper on the claims of labour in the engineering industry by J. R. Richmond. He told the Glasgow University Engineering Society that 'The position just before the outbreak of war was that, by persistent disregard of the terms of the agreement, many of those provisions, although officially effective, had become inoperative, and those inroads on the power of management in the shops had become so serious that, had war not intervened, the autumn of 1914 would probably have seen an industrial disturbance of the first magnitude' (1917:20). It is clear that employers could be persuaded, or coerced, to put skilled men on the new machines, or that they did so because they believed the work to be done justified it. A circular letter from the Manchester District of the Engineering Trades Employers Association in 1907 chided its members for putting skilled men on 'turret, capstan, semi-automatic and automatic machines generally'. 'The committee are of the opinion that if the maximum advantages are to be obtained from these machines, it is most important that when first started they should be manned by youths or handymen who should, if necessary, be instructed by the foreman of the department or by an inspector from the maker's works' (eef/237/1/161).

On the other hand it should be noted that the struggle was largely confined to the older industrial areas in the North East and Lancashire. There are very few references to similar struggles in the newer industrial areas. Moreover the challenge in the workshops assumed serious proportions only in the years of widespread and general labour unrest before the war. Louis Cassier thought that for the two years after the 1898 dispute 'work has been carried on with good will (1899:497). And on the eve of the great unrest, Benjamin Taylor, while attacking the boilermakers for sectional strikes thought that 'the engineers as a body have been loyal to the

agreement and that if it has not preserved unbroken peace it has at all events prevented actual war during the past twelve years' (1910-11:64).

When war did break out a few months later, the employers were certainly under pressure and giving ground. But the EEF also responded with considerable sophistication. In many cases the EEF recommended caution and the exercise of discretion in considering any departure from existing practice. Their tactics, the Executive Board of the EEF explained in a letter to members, was to restrict any dispute to the shop in question and avoid a general lock out. 'So far', the Board assured members, 'these tactics have been satisfactory and a general lock out avoided' (eef/237/1/160). Failure to agree at Central Conference in 1911 on a number of disputes led to series of special conferences on the machine question the following year, winning time for the employers, but without any general resolution being arrived at. Meanwhile the machine question was settled case by case, as the employers intended, even if it meant making concessions. On the North East coast, a five week strike was settled after 'it was ascertained' that the man on a disputed machine was a turner and the firm agreed to consider the question of his wages. At Crossley Bros. in July 1914 it was agreed to pay the skilled rate when the machine was doing certain kinds of work without conceding the rate for that machine or its operator more generally. In September 1914 the EEF advised John Dickenson to put a turner on a Kearns boring and facing mill, and advised Caledon and Co. of Dundee to use a machineman on a Kearns boring machine only for small work done in large quantities, 'but where a greater variety of work and in smaller quantities is to be done the machine justified the appointment of a turner' (eef/237/1/1/10). Had war not intervened J. R. Richmond might have been right about an industrial disturbance of the first magnitude. But the ground captured by



the skilled men in the years before the war did not reverse the radical changes underway in the workshops.

### **Employer Strategies - Deskillling the Job**

The war, as we have already seen, exposed the vulnerability of skill to 'repetition methods' even where skilled labour was only displaced indirectly, but brought few lasting changes. When the 'industrial disturbance' came in 1922, and the unions suffered a second defeat, employers continued to manage the machine question much as they had done before the war. Some employers continued with their tacit agreement to union rates for men operating certain machines and the EEF continued to complain about it (EEF Minutes March 1925). The Federation itself, despite its overwhelming victory, displayed a certain 'constitutional' frame of mind. When Willan and Mills sought EEF advice on replacing a capstan lathe with a semi-automatic Ward Capstan to be operated with semi-skilled labour, they were told to run both machines together for a period and then give the required ten days notice of a change (eef/237/3/1/162). In 1926 the EEF agreed that Rover could continue to employ women on a number of trimming operations only after checking that this had been the company's practice before the war (EEF Minutes March 1926). In general terms, the EEF maintained 'the line that in Engineering there are certain classes of work belonging to the skilled men, other classes of work belonging to the semi-skilled men, and the unskilled work upon which labourers are employed' (EEF minutes July 1936).

The interesting thing about such a formula is that it recognised continuing rights that workers had to work of a certain kind. Some work 'belonged' to skilled men. It was just that employers claimed the right to decide what it was. They were sometimes prepared to go to great lengths to prove they were right. In a

conference on a disputed machine in 1921, the employer brought samples of the machine's output to the conference table 'and it was demonstrated to the union representatives that a turner's skill was not required for the work' (eef/237/3/1/162). When the AEU replied that the machine was *capable* of producing skilled work, the EEF invited them to raise the issue again when the work being done was skilled. In the case of a 'snow grinding machine' at Brierly and Kershaw in Rochdale, 'the firm was advised to work the machine by skilled labour' (eef/237/3/1/162). But similar claims on Churchill Grinding machines were rejected at Mitchell and Shakleton in Manchester in 1920, and on universal grinders at Hacking and Co. in Bury in 1921 (eef/237/3/1/161).

The EEF's 'constitutionalism' and its recognition of workers' property rights in work provided unintended supports for 'craft' claims but it should not be supposed that the EEF was without a conscious deskilling strategy<sup>7</sup>. The Federation was prepared to designate certain work as skilled and 'belonging' to the skilled man, but at the same time, advised every effort to be made to change the character of the work to avoid the necessity of so doing. The clearest expression of this policy came in a discussion of the problem of 'dilution' in 1936 in which the EEF distinguished between the introduction of semi-skilled labour, and dilution defined as the direct replacement of the skilled man. On a number of occasions the EEF had advised firms not to introduce women onto certain work, actions which would have raised the question of dilution: 'So far the Federation had advised that such dilution should not take place, relying upon the much broader and more important policy of penetration of semi-skilled male labour'. The AEU would, of course, complain that semi-skilled labour took work away from the skilled men. 'As a matter of fact', the EEF continued, 'this must arise, but the dilution problem as such does not enter into the situation so long as managements introduce these semi-



skilled men on suitable work provided through de-skilling the operations and by the supply of jigs and tools'. And in case this was not clear enough, the Board went on to issue the following advice to firms on how to avoid the question of dilution arising in the case where trainees from government centres were involved. 'The Director appealed to members of the Council to use their influence in their own areas to prevent such cases arising and to see that the penetration of semi-skilled men in the industry is carried on in the proper way - by de-skilling the work and making it a semi-skilled job before the semi-skilled man is put on it' (EEF Minutes July 1936).

In some ways the EEF's distinction between dilution and semi-skilled penetration was a curious one. It was taken to mean, for example, that dilution involved substitution for skilled men where work was done by the same methods, that is 'without deskilling the means or methods of production'. By definition it is hard to see how substitution by semi or unskilled labour could take place under such circumstances. In practice dilution was usually taken to mean the employment of women, and in this area the EEF was extraordinarily cautious. In 1919 Armstrong Whitworth were advised not to extend the employment of female labour (eef/237/1/1/18), and in 1924 the EEF engaged in a lengthy investigation of a British Westinghouse plan to employ women on 'new business' (EEF Minutes Feb. 1924). A somewhat different, but just as cautious, response was received by Triumph who were told not to confront the employment of women directly but to let it develop and claim local practice (EEF Minutes Dec. 1927). In 1933 R. A. Lister dropped their proposal to employ women after the matter had been referred to the EEF Board who were concerned that firms showed a growing inclination 'to give serious consideration to this subject' (EEF Minutes Oct. 1933). Three years later Harrison and Co. of Lincoln were told directly not to employ women on

moulding machines. This would be a change of practice and lead to conflict with the unions. Federation policy was to expand production by training semi-skilled labour (EEF Minutes May 1936).

Whether logical or not, the EEF's distinction was, of course, a way of getting round the skilled man's property right in his job and the necessity to fight him over it; a way of reconstructing the labour process around him. When the Firth, Brown Foundry in Sheffield was faced with claims from the National Union of Foundry Workers for the skilled rate on certain work, the firm turned to the EEF for advice. The Federation found that many of the jobs in dispute were skilled but that with the right equipment they could be deskilled. The firm was advised to adopt the necessary changes in equipment and their attention drawn to companies which had successfully adopted 'mechanical aids'. In the meantime they were also advised to increase the numbers of workers on the skilled rate (EEF Minutes Oct. 1934)

### **The Machine Question - Pay and Staffing**

Throughout the 1920s and '30s the Federation conducted surveys on the machine question, usually in response to queries from members faced with trade union claims. In every case the surveys reveal a wide range of practice within and across districts for the same machine, sometimes staffed by skilled men, sometimes by semi-skilled, and with a range of rates being paid. In some cases the differences may reflect the fact that skilled work could be turned off on the same machine used for semi-skilled work. Sometimes they will be the result of a compromise between employers and employees. But the variations are so wide and systematic that they must reflect a substantial degree of success by employers in imposing a policy of paying for work according to the skill of the operator, the type of machine, and the



quality of the work. It was, after all, the unions' policy to achieve the skilled rate, the employers' to make judgements about degrees of skill.

A survey on the staffing of Roby Smith Gear Planers in 1920 produced replies from various firms in Manchester showing handymen employed at 45 shillings, semi-skilled men paid 46 shillings, and skilled men paid 49 shillings (eef/237/3/1/162).

North West employers, asked to comment on staffing of Gisholt Universal Turret lathes on screwing work, found nine firms were using turners or apprentice turners, six were using semi-skilled men and one firm, handymen.

In Birmingham in 1925 one firm reported using skilled men on the Richards Turning and Boring machine who were paid between 37s and 46s depending on the class of work being done. In Leeds two firms reported using semi-skilled machinists paid between 38s and 44s (eef/237/13/4/5). In East Anglia one firm paid a highly skilled man 61s 8d, another a machineman at 28s. In the East Anglian case there was probably a considerable difference in the work done. But in 1928 a firm in Birkenhead reported semi-skilled men paid 42s for using a Pearn's No3 Horizontal Boring and Facing machine for boring and facing 'cylinders and similar'. On the North East Coast a firm reported skilled men paid between 46s and 49s for boring and facing valves and cylinders on the same machine.

In many cases the range of rates paid to skilled and semi-skilled overlapped. In 1933, on the Kendall and Gent Horizontal Boring machine, 15 firms paid skilled men between 42s and 54s 9d; 4 firms paid semi-skilled or machinemen 34s 9d to 45s. On Duplex Boring Mills in the following year it was found that 34 firms paid skilled rates from 42s to 48s, while six firms paid semi-skilled workers between 35s and 44s. This pattern is repeated for a range of machines; Churchill surface and

universal grinders, Herbert Turret lathes, capstan lathes and Archdale vertical millers, with the balance between the number of firms using skilled or semi-skilled labour shifting according to the machine. East Anglia summed up its use of vertical millers in 1935 with the phrase, 'used by Tradesmen or labourers as required'.

The structure of engineering wages was such, with war bonuses and nationally agreed additions topping up pre-war district rates, that differences in pay for the same, or similar, work was inevitable. Different practices in deploying skilled or semi-skilled labour on the same machine and at varying rates of pay further bedevilled this already potentially chaotic payment pattern, to say nothing of the effects of payment by results. Local custom clearly mattered too. In London one firm reported paying a grinder on a snow grinding machine '40s 11d plus ten shillings which we believe is the London grinders rate. He has since had some ability money added to his wages and his present pay is 48s 11d plus ten shillings'.

It has been argued that the role of skilled men in domestic bargaining enabled them to maintain *earnings* differentials, even if the *wage* differential shrank (Hart and McKay 1975:39; Penn 1980). But in the circumstances described above, this can hardly be taken at face value as a measure of skill. Moreover, even before skill shortages began to emerge the EEF was concerned that, 'in many cases the piecework earnings of semi-skilled operators are unfortunately greater than the time work earnings of skilled operators' (EEF Minutes Nov. 1934). Earnings figures compiled by Knowles and Roberston for 1948 seem to confirm this as a pattern.



**Table 8 Earnings of Turners and Machinemen 1948**

Occupation	Average Weekly Earnings (Shillings)	
	Jan. 1948	
	Time	PBR
	Workers	Workers

Turners and Machinemen		
------------------------	--	--

(rated at or above fitters rate)		
----------------------------------	--	--

134.9	
-------	--

150.7
-------

Turners and Machinemen		
------------------------	--	--

115.3	
-------	--

138.7
-------

(rated below fitters rate)		
----------------------------	--	--

Source: Knowles and Robertson (1951:83)

Being paid a semi-skilled rate for a job is one thing. Being paid the semi-skilled rate when others in the same works or district are paid the skilled rate is likely to prove intolerable in the long run. The exercise of the employer's absolute right to manage had created a jungle of occupational categories and pay rates that was a constant source of irritation before skill shortages added new pressures. From being a rallying cry that united employers, the right to manage became an increasingly meaningless slogan that could not address the specific problems that the EEF's membership faced. In the workshops of the London and North East Railway AEU men could be transferred from grade 3 to grade 1 work, receiving the appropriate rate of pay for the work at each grade (AEU Aug. 1924). At the Austin a labour grading system was installed with three grades of semi-skilled labour defined (Engelbach 1928a). But the EEF could not, or would not, negotiate a grading arrangement for the industry. As the number and variety of machine processes multiplied, the Federation continued to insist that every case must be judged on its

merits. What had once been tactical flexibility looked increasingly like a mixture of indecision and inflexibility.

Unions continued to insist, where they were able, on the removal of semi-skilled workers and their replacement by their skilled members. But on the ground, the struggle mostly revolved around the rate for the job. At Siemens in 1937 there was a strike after a labourer was put on setting milling machines worked by women, and paid 10d an hour plus bonus instead of 1s 1d plus cost of living. The first time the new setter went to work there was a strike, in which the setter, Brother Partridge, participated. The strike was settled when it was agreed that Partridge should be paid the skilled rate (Siemens Journal No32). It was impossible to bargain about the right of the skilled man to follow the machine or the employers right to manage, but there was room to do business on the rate for the job. The AEU's Birmingham organiser failed to persuade GEC to pay the skilled rate on a Richards Horizontal Borer used for a single purpose job. But the firm agreed to reconsider the question if the machine was used for general work, an advance was conceded to one man on a boring machine bringing him to the full rate, and it was agreed that the rate to be paid to capstan operators should be settled between shop stewards and management (AEU May 1930). In 1935 the AEU organiser reported a works conference at Armstrong Siddley in Coventry, 'to consider the question of the splitting up of jobs in area engine fitting shop'. It was the union's contention that 'unreasonable reductions in prices had taken place during this arrangement' (AEU Feb. 1935).



## **Trade Union Demands for a Grading System**

At the conference table the engineering union continued to pursue its demand for a negotiated settlement to the machine question. But if the employers were constrained by their insistence on managerial rights, the AEU was hamstrung by its refusal to co-operate with other unions, a weakness of which the EEF took full advantage.

Proposals from the AEU in 1920 essentially reiterated the rights of the skilled man but led, in November 1921, to the appointment of a joint sub-committee with the EEF to investigate the question. In the event, the sub-committee did not meet until July 1923 when the union suggested that the employers put forward their own counter proposals, and the sub-committee arranged to meet again in September. Meanwhile the EEF agreed to meet the National Federation of General Workers in August, and the General Workers insisted that 'their members who have the aptitude and qualifications shall not be restricted in the use of any machine in the evolution of the engineering industry' (EEF Minutes Feb. 1924). Confronted with the outcome of the EEF's meeting with the General Workers, the AEU negotiators in September could only report the matter to their Executive Committee. In August the EEF had told the Derby Association that it could not respond to local claims for a negotiated rate for machinemen because this was now the subject of national negotiations. The Federation now responded to all general approaches, including a further approach from the General Workers in September, with the statement that they could do nothing until they heard from the AEU's executive. In 1925, the AEU's request for a meeting to discuss pay for machinemen in the textile machine industry was refused on the grounds that the EEF was still awaiting the AEU EC's reply (EEF Minutes Sept. 1925).

In the same year, however, the EEF did concede the claim from the National Union of General and Municipal Workers for 2s on the rate for labourers in Lancashire and Cheshire who were put on machines, an agreement subsequently extended to Bradford with the clarification that it was 2s on the district, not the workshop, labourer's rate (EEF Minutes March, April 1925).

It took the AEU four years to get back into the game. It did so in 1929 by appealing for a fresh start to negotiations. The AEU would still not 'even consider the question of sitting down' with other unions but 'the union representatives had intimated that they were prepared to proceed with the discussions on the basis proposed by the Employers, viz. the skill required of the operator, the machine he is working, and the work upon which he is engaged' (EEF Minutes Oct. 1929).

This put the EEF in a difficult position and a special committee was authorised to discuss the machine question on this basis. But an excuse was soon found to pull out. The government's proposed Industrial Employment Bill was said to offer such a threat to the liberty of employers that negotiations could only continue with the AEU when the whole of existing working conditions had been reviewed and put on an economic footing. In May of the following year the NUGMW indicated that they would withdraw their 1923 demands for a removal of restrictions on their members, agree the same formula as the AEU, and to act jointly with the AEU in conference. The EEF delayed once more, this time awaiting a reply from the Workers Union and a report on working conditions (EEF Minutes May 1930).

It may be dangerous to deduce too much from these manoeuvres at national level. There may have been many companies in the EEF who wanted negotiations as well as many skilled men back in the branches and the workplace who preferred more traditional methods. But arguably they do indicate the nature of the relationship



between the two. The AEU, implicitly from the turn of the century, explicitly at the end of the twenties, was prepared to pursue the interests of its members within the framework laid down by the employers. The latter clearly felt themselves in a sufficiently strong position to keep the unions at arms length. The negotiations also suggest that the AEU had long since ceased to hold out any real hope that craftsmen could follow the machine. What was at issue now was the rate of pay for a hierarchy of skills, most of which bore only a passing resemblance to the pre-war 'craft'.

In 1936 the NUGMW and the TGWU cancelled the Lancashire Machine Agreement with the EEF as a preliminary to talks with the AEU on a new joint approach on the machine question. New proposals were subsequently tabled to the EEF late in the year. They were predictably ambitious with nearly all the new machine trades, from planers to capstan operators who set up their own work, being placed in the skilled category. More modest proposals were again submitted in 1937 but these did not find favour either. Two years later the negotiations were revived when the EEF agreed, 'for tactical reasons', to a new joint sub-committee (EEF Minutes Oct. 1938). But despite agreeing arrangements for dilution in 1939, the EEF would not budge from its refusal to entertain any kind of grading scheme to address the 'machine question', a refusal reiterated on a fresh approach from the unions in Jan. 1942. In 1944 there were signs that the EEF was more divided with some districts arguing that a machinists wage rate agreement would help to keep the machinists pay below the skilled rate, but the line held (EEF Minutes Jan. 1944). Indeed, in August and December of the same year, the EEF also rejected proposals from the unions for the grading of clerical jobs 'according to the nature of the work performed and the degree of responsibility carried' (EEF Minutes Dec. 1944).

The unions were nothing if not persistent. New proposals for a three grade structure, 'engineering craftsman, skilled operator and labourer' were submitted in Aug. 1946 and a six grade scale in 1949, starting with labourers and moving through skilled to super skilled. All to no avail. The EEF established a committee of experts in 1946 which took evidence from members of the Federation. It concluded, predictably enough, that a national grading scheme was impractical given the endless variety of 'methods employed by individual firms making the same product'. The committee could not even agree that there should be a minimum starting rate for labourers promoted to a machine, with periodic increases after that (EEF Minutes Feb. 1946).

That endless variety also makes it difficult to sum up what had happened to machinemen and skilled workers between the wars. On one account in the AEU journal, 'the only people near the work who may accurately be classed as skilled being the foreman, chargehands, markers out, machine setters and tool makers' (AEU Feb. 1937). Only at the periphery were there skills to be found which could be compared to the pre-war crafts. Many of the machinemen had been absorbed into that part of the skilled workforce deployed in production. In 1946 the EEF Board found that 29 members of the Federation trained or apprenticed boys for between three and five years to become planers, slotters and shapers and that, in the majority of cases, paid the turner's rate after the training period. On the other hand the Board found that, 'notwithstanding the restrictions which the trade unions had been able to impose in certain districts and on certain individual firms, there were still extensive federated regional areas, such as the Midlands and the South and West of England, where men were promoted from the floor to such machines



as slotters and shapers, apprenticeships to this class of work being practically unknown' (EEF Minutes May 1946).

In part the absorption of machinemen into the ranks of skill will have been determined by the trade union action referred to above, and this will have been made easier where firms were engaged in the older sectors of engineering as was more likely to be the case in the North and the North West. It was also encouraged, as we have argued above, by the inability of the employers to create any systematic training alternative to the institution of apprenticeship and the refusal to create or negotiate occupational structures for an industry where employers were simply advised to exercise their rights. However, to see this process as one in which craftsmen successfully defend their central role in production, or as a labour process in which employers remained dependent on skilled workers, is to mistake the forms in which the various struggles were played out for the substance. The machinemen were absorbed into the ranks of a hierarchy of skill which they created, a process which had much more in common with the deskilled labour on the 'execution' side of the conception/execution divide than it did with the craftsmen who, together with the foremen, worked out how to make a product from the bare details provided from the office.

## **Conclusion**

In this chapter we have seen how the position of the pre-war craftsman was undermined by mechanisation and its management from the office. Skill did not disappear altogether. There was still a need for some workers to have a greater knowledge of materials and processes, and the associated manual dexterities, than others. Nevertheless, new tools, and the rise of new forms of production management, constituted a qualitative break in longer term trends. If we could

speaking, in however highly qualified a sense, about a craft mode of production at the turn of the century, that notion is no longer applicable after the first world war.

The better educated and more skilled workers found new jobs in the office or were increasingly located on the periphery of the production process in the toolroom and maintenance shop. This reconstitution of the labour process was reflected in the (largely unsuccessful) attempts to adapt the institutions of apprenticeship and training to the need to produce a much more highly differentiated workforce; in the changing composition of the workforce, including the new importance of the machinemen; and in the shifting location and composition of the industry itself.

Engineering employers pursued a conscious deskilling strategy. Their declared aim was to deskill the job rather than the man. They recognised that deskilling the man was a necessary consequence of deskilling the job but hoped, in this way, to limit the scale of conflict in the industry, and this accounts both for a certain 'constitutionalism' in the employers' approach and their extraordinary caution in cases involving the employment of women.

There is a point of considerable significance here. We have noted on a number of occasions that, in Britain, the jig and tool designer had a greater impact on the skilled man than did the efficiency engineer. The EEF attempt to distinguish between deskilling the job and deskilling the man is consistent with this experience. Skilled engineering workers were more familiar with Taylorism as the management of mechanisation than from the office than the reconstitution of the labour process through shop floor time and motion studies. This remained true throughout the 1930s, despite the spread of Bedaux, with skilled men only drawn into the industrial engineering net on a significant scale during and after the second world war. However, by that time few of these skilled workers were 'craftsmen'. The



direct application of Taylorist schemes was only one element among a number of related developments reconstituting the labour process in similar ways.

Skilled men fought a stubborn rearguard action against all of them. But their successes have been wildly exaggerated. The struggle was conducted from job to job, around rates of pay and machine staffing, in ways which could only limit the rate of change. There was nothing resembling a struggle to defend a craft mode of production, nor could there have been, since the conditions for such a thing were rapidly disappearing from the turn of the century. The left appealed for an end to the craft mentality, but with only limited success, since so many members in the workshops set their faces against change. This was not, however, a sign of strength or of the 'continued centrality of the skilled worker', but of narrow conservatism which appealed to a steadily shrinking section of industry.

The union was forced to adjust more rapidly than its members. From 1929 the AEU was prepared to accept the employers' position as the basis for negotiations on the machine question, the aim being to secure a grading scheme to protect the position of the craftsman, or super-skilled, within a new hierarchy of skills. Employer obduracy in the face of trade union realism prevented any such scheme being established. The paradoxical consequence of the inflexible exercise of employer power was to create bargaining pressures and patterns at workplace level which were much more influential for post-war developments than any survival of 19th century craft worker traditions.

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## Notes

<sup>1</sup> For America, Montgomery notes that, 'Paradoxically, machinists became increasingly craft conscious as their craft became harder to define' (1989:182). Hobsbawm (1984) makes too many concessions to the new historians in accepting that 'sheer bloody minded shop floor resistance reversed the total victory won by the Engineering Employers Federation in the 1897-98 lockout' and that piecework was an alternative to Fordist strategies.

<sup>2</sup> The 'need' to degrade the intelligence was universally understood. As the ILO put it, 'It would be vain, and even dangerous to re-introduce intelligence and initiative in workshops where the output depends entirely on automatic machinery. Rationalisation pre-supposes a great intellectual effort on the part of the "brain" of the factory - the central offices and research departments' (quoted in Devinat 1927:xi)

<sup>3</sup> That is to say, a force determining the design or nature of the technology and consequent deployment of labour, as opposed to 'the attribution to workers of labels denoting them as skilled, semi skilled or unskilled, together with the differentiation of wages and status which usually accompanies such labelling' (More 1980:16)

<sup>4</sup> There is an EEF file dating from the 1940s which suggests that there was hardly any change at all in skill composition for adult males (eef/237/13/3/44) but this is wholly at odds with the many reports in numbers of skilled and semi skilled workers for the inter-war period which all tell the same story. Excell recounts how ordinary labourers at Morris motors were re-classified as skilled when the second world war broke out (1978:65).



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<sup>5</sup> Haydu says 'Coventry suggests a pocket of American conditions in England' (1988:122); Butt (1960) makes much the same point.

<sup>6</sup> Frank Smith from the AEU Branch in Battersea wrote pointing out that, 'As the instruments of progress the operative engineers have been used first, to dilute and simplify the labours of all other workers. Parallel with this we have greatly simplified and diluted our own, and in the very nature of things this process must continue. Progress demands and insists on the simplification of the methods of production'. (*AEU Journal* Sept. 1923).

<sup>7</sup> Zeitlin argues that even the EEF victory in 1922 was 'ambiguous', that employers were 'reluctant to assume full control over the production process' which vastly overstates the case. In the circumstances it is not surprising that Zeitlin should conclude that 'Great mystery surrounds the failure of British engineering employers to develop more effective mechanisms to control the recruitment and reproduction of skilled labour at local level' (1991:74).

## **Chapter 5 From Premium Bonus to Bedaux**

### **Introduction**

Before the first world war premium bonus led the way in workshop reorganisation, spearheading the drive to extend piecework, providing new management tools and a focus for shop floor anger and resentment. In the years before the second world war the self-consciously scientific management efficiency system devised by Bedaux played a similar role. In this chapter I discuss the nature of the Bedaux system and its role in the development of modern work study and explore the relationship between, on the one hand, Bedaux and employers and their managers, and on the other, between Bedaux and workers and their trade unions.

Bedaux was an explicitly Taylorite system of labour management. But it did not operate in a vacuum. In keeping with the argument of this thesis, I locate the Bedaux system as part of a wider trend towards tighter time-study standards and discuss the relationship between Bedaux and other schemes of payment by results.

Within this framework a number of other issues are addressed including the impact of efficiency systems on semi and unskilled men and women as well as on skilled men; the degree of management control of piecework; the tensions within the Bedaux company itself and their implications for managerial strategies and Bedaux applications; the impact of worker resistance and the speed with which the trade unions reached an accommodation with Bedaux and work study.



## **The Spread of Piecework and the Decline of Premium Bonus**

A Board of Trade estimate for 1906 put the proportion on workpeople on some form of payment by results at 28% (Richardson 1933:192). Cole's survey of the position in a number of industries at the conclusion of the first world war found a similar pattern, and although he would not hazard a guess about the proportion of workers paid by results, he was in no doubt that the various systems were spreading (1918:9). In fact, estimates of the numbers paid by results for the end of the 1930s do not show a dramatic change from the earlier period. In 1938 some 25% of wage earners in all industries were paid by results, with a higher proportion of 33%, in manufacturing industry. The numbers on some form of piecework probably increased at a faster rate during and after the second world war. Enquiries by the Ministry of Labour for 1961 showed a third of all workers, and 42% of employees in manufacturing industry, on payment by results (ILO 1967:55; Marriott 1957:49; NBPI 1968). But piecework was spreading faster in some industries and for some kinds of workers than others.

Roughly a third of engineering fitters and turners were on piecework in 1906. By 1914 nearly half the fitters and 37% of the turners in the ASE were on piecework and the numbers grew rapidly during the war. They grew fastest among the new 'machine trades' and among the turners. By 1923 more turners than fitters worked piecework and by 1940 'the proportion of turners and machinemen on piecework was between 75 and 80 per cent' (Jeffreys 1945:210; McLaine 1944:630). Wide regional differences remained. In Birmingham and Coventry, between two thirds and three quarters of *all* classes of engineering employees were paid by results as early as 1931 (eef/237/13/3/22). Engineering workers had voted solidly against premium bonus before the first world war, and against piecework in 1920. By

1928, with so many members paid by results, the AEU National Committee resolved to seek a new national agreement to control it (Milne Bailey 1929:420).

It has often been remarked, and with some justice, that it was difficult to apply piecework on highly skilled operations, but all the evidence suggests that piecework was more problematic in the case of unskilled workers than skilled. 'Generally speaking, noted the ILO, 'skilled workers are paid more frequently by results than unskilled workers and women more frequently than men' (1967:91)<sup>1</sup>. Semi-skilled workers headed the piecework league in engineering, but skilled men were not far behind. Knowles and Robertson identify payment by results workers as a percentage of engineering workers between 1926 and 1948 as follows

**Table 9          Payment by Results Workers as % of all engineering workers  
for three grades of skill**

	Skilled	Semi-skilled	Unskilled
1926 (Oct.)	51.1	na	13.9
1928 (Oct.)	55.0	na	14.5
1931 (Oct.)	56.1	na	16.3
1938 (July)	62.1	80.8	14.8
1942 (July)	69.9	82.3	22.6
1948 (Jan.)	60.8	84.5	22.6

Source: Knowles and Robertson 1951 p189

Ministry of labour figures for the mid 1960s show a smaller proportion of both skilled and semi-skilled on payment by results - 49.2% and 53.2% respectively -



with the gap between them much narrower but with the percentage of unskilled workers still at 21.6%. In 1961 across a range of manufacturing industries, mining, transport, public utilities and some services and public administration, 44% of women were paid by results against 30% of men (NBPI 1968:77,78).

As piecework spread, premium bonus declined (Yates 1937:86). In 1930 the Glasgow manufacturer, Sam Mavor, estimated that in the West of Scotland, where the Rowan system had been particularly popular, 19% of those on payment by results worked under premium bonus and 24% on some form of individual piecework (1930:13). But elsewhere premium bonus probably accounted for a considerably smaller proportion. Straight piecework had come into its own since the war, H. C. Armitage told the production engineers in 1931, 'and has ousted premium systems, Rowans and about three hundred variations thereof (*Proceedings*, Production Engineers 1931-32). The EEF ceased to collect figures for premium bonus in the 1920s and in 1936 the TUC thought premium bonus systems were no longer widely used (tuc/292/112/1). But the new piecework schemes were not a reversion to earlier money bargains even if the language of 'piecework prices' continued to be used. They were usually based on calculations of time and with more careful, if not 'scientific', rate fixing.

There is no doubt about the reason for the decline in popularity of premium bonus from the employers' point of view. Such schemes were now widely regarded as a provocation to restriction of output and an abdication of the employer's responsibility for rate fixing. A contributor to discussion among production engineers of a paper on payment by results was roundly applauded when he declared that 'the presence of the Rowan system in any shop is as good as an admission on the part of the management that they do not know anything about

setting times and rates' (*Proceedings, Production Engineers* 1930-31). Whether the move from premium bonus to piecework was always accompanied by more rigorous rate fixing in practice is another matter. Sunbeam motors replaced premium bonus for a time-based piecework scheme in 1923 without any apparent upheaval in methods. Workers were guaranteed the whole of any time saved at their ordinary time rate and it was agreed that, 'Time fixed for each operation or piece of work shall be settled by mutual agreement between the management and the workmen concerned', though the commitment to mutuality did not last (AEU Feb. 1923; DSO/23/21). The question we must now consider is how far the shift from premium bonus to piecework, and the critique of the rate-fixing practice associated with premium bonus, meant the adoption of time and motion study approaching a Taylorist model.

### **Rate Fixing and Time Study Between the Wars**

There was certainly a new post-war awareness of the need for systematic time study to be carried out by a rate-fixing department rather than the foreman. In 1919 Maxwell's paper on scientific management in *The Engineer* had argued that 'without accurate measurement of work payment by results is only a catchword' (Dec. 1919). And in the following year *Cassiers* and *Engineering* both called for more scientific rate fixing to overcome objections to piecework. But this was not as straightforward as it sounded. There are three aspects to consider; the degree of rigour in time study, the use of motion study, and the production organisation which forms the context for work measurement.

We have already discussed the difficulties in distinguishing rate fixing from time study when we discussed the origins of premium bonus (chapter 2). Rates could be set by guesswork, usually on the basis of experience; from records accumulated



over time, which amounted to a more systematic ordering of experience; from time studies aimed at measuring floor to floor times; or from a time recording of each element of the job. In practice all of these methods could, and did, exist side by side. Nor were they always distinguishable. A visitor to the Production Engineers in 1926 told the speaker that 'You have passed absolute condemnation on the guessing ratefixer but it seems to me that it is all guessing'. To which the speaker could only reply that 'It is a rather difficult subject. There are guesses and guesses. The trained man guesses, but he instinctively knows' (*Proceedings, Production Engineers 1925-26*). *Engineering* had called for careful time study done on each of the elements of the job but recognised that 'there are very few members of our staffs today who have become accustomed to subdivide jobs into their elements and to assess the correct time for the carrying out of these elements of work' (Feb. 1920).

A second difficulty lay in motion study. 'Briefly, ordinary rate fixing merely estimates the time an operator will take to do a job, leaving him to find out quicker methods himself, under the incentive of increased pay,' a speaker told the Birmingham section of the production engineers. 'Time and motion study work is different. A study is taken to find out which motions are necessary, which are not, and what time they should take. The unnecessary motions are eliminated..' (Wilson 1934). But this degree of integration was comparatively even less frequent than rigorous time study. In Britain, the split between Taylor and Gilbreth, between time study and motion study, was sharper than it had been in the USA. Motion study in Britain developed through the work of the Industrial Health Research Board, the National Institute of Industrial Psychology, and the work of Anne Shaw at Metropolitan Vickers and the Ministry of Aircraft Production. Again, in practice, distinctions were blurred as motion study experts carried out time studies

and work measurement included an element of motion study. But when industrial engineers in Britain organised their own professional bodies they established one for motion study and another for time study.

A third, and critical, consideration was the sophistication of the production organisation within which time and motion study was carried out. J. E. Powell, author of the standard work on payment by results in the 1920s, told the newly formed Institute of Industrial Administration that inefficient output was largely due to faulty organisation and that payment by results could only be a stimulus to production not a substitute for efficient works organisation (*The Engineer* May 1920). And he warned his readers that the right remedy for the production problems they experienced may not be payment by results at all 'which, by inference, places the responsibility for low output upon the workers, but is rather the acquirement, by management, of efficient production knowledge and the exercise of suitable production control'. Payment by results in an inefficient works would simply build inefficiency into the job, 'what is called for more than anything else is production knowledge; what appears to be necessary is a revolution in production management' (1924: v,10).

Powell's point was widely understood by contemporaries. *Engineering* coupled its call for more scientific rate fixing with the strong advice not to introduce rate fixing or payment by results until 'the methods in vogue in the shop are the best possible for the plant available' (Feb. 1920). This was advice repeated by production engineers in the 1930s and by the British Government in its evidence to the ILO after the second world war (ILO 1967:167). It was, of course, one of Taylor's central themes and the cause of much argument with employers who engaged his services. It focused attention on the links between production engineering and



work measurement, and though clearly sound advice, was extremely difficult to carry out. Time and motion study, no matter how rigorous, would always be the subordinate element in the larger production plan if carried out according to Taylorist design. But quite apart from anything else, it was difficult to know what *were* the best possible conditions, and in any case, managers felt the need to act in the here and now. Some of the implications for rate fixing were brought out by T. E. Pattinson, works manager at Associated Engineering, who argued that rates should be fixed on the assumption that the best machines were in use and a process allowance added to compensate for poor conditions (*Proceedings, Production Engineers* 1925-26). This may have been theoretically possible but was clearly very difficult and unlikely to be widely adopted as practice.

Measured against exacting standards of time study, motion study and production organisation, British practice was limited and uneven. G. H. Nelson, works manager at Attercliffe Common works in Sheffield, acknowledged that 'there are many so called rate-fixing departments in most works, but in many cases they are not sufficiently organised' (*Engineering*, March 1924) and L. Clayton told the production engineers in 1931 that time and motion study as he knew it elsewhere 'is practically unknown in Great Britain, particularly with reference to engineering' (1931:371). In fact, the experience was more mixed as testified by a rate fixer writing in *Machinery* in 1931. Claiming to present a representative selection from his own experience, 'SWH' described careful time study applied in one motor company on the basis of a system imported en bloc from the USA; in another there was no rate-fixing department and the foreman fixed piecework prices. In a motor car presswork plant he found detailed time study for assembly and machining; at a transmission chain makers, premium bonus and at a machine tool works on small

batch work, gangs worked to prices fixed by a combination of speed and feed calculations and rule of thumb (*Machinery* Nov. 1931).

But there are examples of developed time study systems, particularly in mass production plants. Whatever may be said about the post-war experience of payment by results in the motor industry, the pre-war systems were tightly organised and involved no suggestion of a surrender of control. At Austin's Longbridge plant, in Engelbach's account, the possible earnings of pieceworkers were worked out theoretically on the basis of the highest possible efficiency and ideal piecework earnings obtained. Actual performance was compared to the ideal standard and 'operatives who were inefficient were weeded out and foremen or charge hands who were not up to the standard were removed to different work or dealt with otherwise'. Each job, it was claimed, was graded by the amount of skill required, an enormous task involving the review of 15,000 to 20,000 operations. 'Even the toolroom', wrote Engelbach, 'has been placed on piecework, with such success that the output was increased by 24% and the number of operatives reduced by 19%' (1928: 510,511). Engelbach's colleague, Perry Keene, claimed the system extended to all kinds of labour in the plant, '.. they unpacked stationery, carried out repairs, ran the whole of the internal transport of their company, and even the washing of offices, and the cleaning of windows on exactly the same system as the manufacturing of a car. They paid purely on time saved and nothing else' (Ward, wa/8/29-34/12, June 1933).

At Lord Lever's Port Sunlight plant a standard unit per man hour was obtained 'after careful measurement of times taken on various productions', and a bonus paid, of between 60% and 75% of the value of the increase in efficiency over the standard unit. And at Rowntree's cocoa plant the job was reviewed before a



provisional time set and adjusted as a final rate after three months (Ward, wa/8/29-34/12, Jan. 1930). More generally, Child has pointed to a shift among Quaker employers during the inter-war period away from notions of industrial democracy and towards a more single minded concern with efficiency. Edward Cadbury had criticised the effects of scientific management on workers 'but by the later 1920's it was not infrequently being legitimised in terms of benefiting these self same employees' (1964:303). The best known example of motion study was, of course, the work of Anne Shaw at Metropolitan Vickers where, as 'chief supervisor of women and motion study investigator', she carried out extensive motion studies and conducted training courses for the whole of Associated Electrical Industries (*The Engineer* Sept. 1933; Williams 1991).

There are also some interesting lesser known examples of advanced practice. The Rolling Mill Committee of the Iron and Steel Industrial Research Council thought that 'the use of time study in the heavy industries in Great Britain is, at present, in its infancy' (Holmes 1934-35; *Engineering* May 1938). It was not, however, unknown. H. T. Hildage pointed to the use of time study at the United Steel Company where separate staffs had been appointed to be responsible for production and fuel efficiency: 'The work of these staffs, in each case, is inspired and co-ordinated by an engineer, who is attached to the personal staff of the managing director ... Broadly speaking their methods are the methods of Taylor and his colleagues and successors, and are designed to suit the conditions of the works in which they are carried out' (*Engineering* May 1931).

The difficulty is that apart from scattered reports, little hard information exists about the degree to which systematic time and motion study underpinned payment systems. Responding to enquiries about the use of time study from the IHRB in

1935, the TUC identified a list of 18 firms using Bedaux including Venesta, Taylor Bros., Manders, Rover, and Crosse and Blackwell. Information about other time study systems was more difficult to obtain. The Boilermakers replied that their members refused to be timed! The GMWU identified Pilkingtons and ICI plants in North Wales, Rowntree and Metropolitan Vickers; their Scottish region added North British Rubber in Edinburgh, a confectionery works where the time study men had been trained at Rowntree and a number of others (tuc/292/571,1/1, 20 May 1935). These lists suggest that, while the growing importance of time study was widely acknowledged, no one really knew just how extensive it was. Nor was there much more information available in the period after the war. When Seymour Melman enquired in 1950 about 'the proportion of operatives in this country whose wages are based on incentive plans and standards derived from Time and Motion Study analysis of unit operations', the TUC were unable to tell him. Nor could the British Institute of Management, who confessed that they had no knowledge of where such information could be found (tuc/292/571,1/, 26 April 1950).

### **Piecework and Efficiency Systems**

The evidence to the TUC from the AEU did, however, suggest that the stop watch was more familiar than the efficiency engineer. 'I have now received replies from our organising District Delegates in regard thereto', wrote the AEU, 'and in each case they report that they cannot supply any information on the lines suggested by you. The only knowledge they have of Time Study Systems is in respect to the use of the stop watch for the fixing of piecework prices. However, I am arranging to have sent to you, particulars of the motion study idea that is operating at Metro Vickers Ltd Manchester' (tuc/292/571,1/, 14 May 1935).



But in this respect, experience in Britain may not have been so far removed from that in America. Time study of the type inspired by Taylor was not confined to 'efficiency systems', and piecework was more common than incentive bonus schemes (Northcott 1950:136). A survey of 672 plants by the National Metal Trades Association in 1930 found that three quarters of all employees were paid by time. Of those paid by results, 50% were on relatively straightforward piecework plans, 21% on premium bonus and only 11% on 'bonus plans'. The use of time study was widespread. Of those reporting, 43% set standards exclusively by time studies and a further 31% by time study combined with some other means (Diemar 1930:51-52). But even in America 26% of companies in this particular survey based their rates on previous performance or guesswork. A more comprehensive survey by the National Industrial Conference Board in the same year produced comparable results. The numbers of all employees on payment by results in the establishments surveyed was higher at 37%. Of these only a little over 15% worked under 'the various specialised incentive schemes' while more than half were on straight piecework (1930:8-9). Of those plants providing information on how piece rates were determined, 25% based their rates on estimates and 63% on 'analysis of the standardised operation, including time study' (1930:47).

The production engineers expressed a clear preference for piecework but were clear that time study was essential. Efficiency systems were continually being brought over from America, noted H. C. Armitage from Austin, but he believed they would never replace piecework. The important thing was to base straight piecework on careful time study. Piecework was cheap and simple to operate, argued E. W. Hancock, but it must have good time study at its root and management should pay more attention to selecting time study engineers than devising elaborate methods of payment. Even more importantly, the right

production conditions must be secured. 'I have taken a considerable interest in incentive systems and in so-called scientific management for the best part of my life', argued P. H. Lightbody at the Coventry section, but 'I am quite convinced in my mind that you will never get the answer to this problem of which is the best incentive system until you start with the other side of the equation and classify conditions' (1930).

Sam Mavor took a similar view in a series of articles for the Institute of Engineering and Shipbuilding in Scotland. 'Without very good management', Mavor warned, 'payment by results is a snare'. It was worse than futile to try to introduce piecework until management had provided the proper organisation and facilities (1930:27). Ford methods of driving the men were inappropriate in Britain, argued Mavor, '... in this country the procedure is more humane, less arbitrary and dictatorial, and psychologically is to be preferred' (1931:65). It is important to note however, that Mavor's humanity did not prevent him adopting F.W. Taylor's system of time study at Mavor and Coulson. Nor was this simply a matter of the rigorous use of the stop watch. 'After the workshop organisation, equipment and services have been brought into line with the necessities of time study, it remains to investigate every individual job before applying time study to it. The best technical skill in the establishment should be concentrated on methods planning and jig and fixture designing. The department is the thinking organ of the workshops, which directs the modes of applying manual labour and machinery to the achievement of the highest productivity' (1931:71). Formerly, argued Mavor, no one knew what a fair day's work was, 'now the firm knows and the men know the firm knows' (1931a:39).



Of course piecework schemes could lend themselves to a loss of managerial control. 'Lazy management', L. H. Lightbody told the production engineers, 'relies solely on the incentive - leaves the worker to do most of the thinking and planning, and later attempts to reduce the prices' (1930). But there was no necessary connection between piecework and a loss of control and no distinction of substance to be drawn between piecework backed by rigorous time and motion study and any of the more self consciously Taylorist efficiency systems. The key, as Taylor had insisted, lay in the degree of production control. In an interesting comment on the changing role of the rate fixer, J. Hannay noted that there were now people who planned the work, estimated the costs and arranged production, telling the rate fixer, 'this is the operation, that is how it is to be performed, and the cost is so and so' (*Proceedings, Production Engineers* 1931-32).

The production engineers who participated in the lectures and discussions about time study and payment by results were hardly typical of industrial managers. The newer industries and motor vehicles in particular, were heavily over represented. They will have been at the forefront of contemporary thinking and practice but their evidence is valuable nonetheless. It reinforces the view that slack rate fixing was under attack everywhere and the bonus schemes designed to compensate for such slackness were in retreat. It suggests that serious consideration was being given to the theory and practice of time and motion study and systems of production control, and that both were firmly located in the Taylor tradition however unevenly and weakly developed that tradition was. For the 1930s attention is inevitably focused on the more dramatic developments associated with Bedaux. That should not obscure the fact that systematic time study was making steady advances and would have continued to do so<sup>2</sup>. Bedaux does not stand as a

scientific management contrast to a reliance on piecework and rate fixing, but as an extreme manifestation of a trend already firmly underway.

## **Bedaux**

When the production engineers addressed the issue of payment by results the Bedaux system was already known to them. In 1931 Bedaux took on assignments at Joseph Lucas and Wolsey Ltd and would soon be notorious, but with only around forty staff and a total of about fifty assignments behind them, the company was still in its infancy. In the USA Bedaux was more firmly established with more than 33,000 workers labouring under Bedaux incentives at the end of the 1920s, more than twice the number on payment plans devised by Taylor, Halsey, Emerson and Gantt put together (National Industrial Conference Board 1930:8). The real period of expansion however, took place in the 1930s. 'So widely were they adopted then, that one might almost call the Bedaux system the Taylorism of the Great Depression' (Montgomery 1989:440). Bedaux grew most rapidly in Britain from the 1940s and most rapidly of all in the full employment years after the war. But there is a sense in which Montgomery's judgement applies. Bedaux was rooted in the 1930s, it was unquestionably the advance guard of scientific management and seen as such, it dominated struggles about the regulation of the labour process and became the standard by which time and motion study was judged.

The first Bedaux assignment in Britain was carried out at Kodak in 1923 but the company was not formally established in the UK until 1926, in the name of Chas E. Bedaux, going public as the British Bedaux Company in 1936. Two years later British Bedaux set up two subsidiaries, Associated Industrial Consultants (AIC) and Industrial and Business Consultants (Inbucon), the latter to serve largely as a telegraphic and cable address. In 1943 Inbucon was established as the holding



company but AIC was the main trading arm and continued to finance the whole group (Brownlow: undated). By the mid 1930s Bedaux was notorious for his friendship with German Nazis as well as his system of labour measurement. According to Norman Fleming, Managing Director in 1936, the name Associated Industrial Consultants was chosen because it 'would not roll off the tongue of trouble makers so easily' (Fleming: undated). In 1987 Inbucon was in trouble of a different kind and merged with PE Consultants.

Bedaux's reputation never recovered from the bitterness of the struggles which his system inspired or his association with German fascism. The Taylor Society even took the unusual step of 'tacitly sanctioning' a strike of textile workers in the American South against the system in 1929 (Nadworny 1955:134). Kreis concludes that 'By the standards of Taylor, his immediate followers, and his intellectual heirs in the Taylor Society, Bedaux was little more than a quack or charlatan' (1992:168). Layton too, argues that 'Bedaux was an opportunist and his system was, in many respects, a perversion of scientific management' (1974:382). Even Livingstone, who concedes that 'most modern work measurement has grown from methods proposed by Bedaux', still describes him as a super salesman peddling a time study system which misrepresented Taylor and was little better than a con trick (1969).

However, neither Taylor nor modern work study can shrug off their relationship with Bedaux so easily. Bedaux refined Taylor's rather crude time study methods in the area of effort rating and rest allowances (Anson 1953; Williams 1955; Blackwell 1956), and even if his efforts proved to be no more scientific than Taylor's, his idea of a common unit of work underpins the modern use of 'standard minutes' (Currie 1964). Bedaux himself was interested in only the narrowest

application of incentives to raise the level of exploitation, but the Bedaux company had broader ambitions and the Bedaux system, stripped of its connections with its founder, went on to exercise widespread influence within post-war management.

### **Bedaux as System**

Bedaux's own book on industrial management was, as Littler rightly observes, firmly within the scientific management mainstream. Time study was described as 'the foundation of practical efficiency' and motion study as 'the recording of the decomposition of compound operations with a view to determine and eliminate all existing elements of waste' (Bedaux 1921:291). And, like 'the masters of the new science', Taylor, Gantt and others, Bedaux's principles of efficiency covered everything from standardised conditions and record keeping to the planning, routing and despatch of work.

The novelty of Bedaux lay in the construction of the Bedaux unit which was supposed to provide a universal measure of labour. Each minute was made up of varying amounts of work and rest which, once determined, could serve as a measure of labour for the purposes of payment by results and provide a management tool for comparing production costs across diverse operations. Precisely because the relationship between work and rest was independent of other characteristics of the work performed, the average worker ought to be able to produce 60 Bs in an hour. A pieceworker should be able to produce one third more, or 80 Bs an hour.

In short, Bedaux claimed to have discovered the 'laws of strain' though he never actually explained what those laws were nor provided any data against which they could be assessed. Brownlow claims that 'Bedaux engineers accumulated detailed



and highly secret lists of appropriate allowances for specific jobs. Today's more scientific allowances are not noticeably different' (Brownlow, undated). But such secrets were so successfully kept that Anne Shaw noted in 1960 that it was impossible to assess the Bedaux system properly because 'there is no comprehensive published work on the method' (1960:5). The only indication of what constituted the laws of strain, which went beyond generalisations about combinations of work and rest, are three 'laws' identified by the National Industrial Conference Board;

'For a muscular effort of a given power, the ratio of strain is directly proportional to the rapidity of motion and completion of the cycle.

'Rapidity of motion is inversely proportional to weight handled, pressure applied and length of cycle.

'For a muscular effort of a given power, the duration of work and rest periods is inversely proportional to the rapidity of motion.'

(tuc/292/112/2/1933 wmb/fp/78)

The only interesting thing about these otherwise common sense relationships is the claim that there is a direct proportionality involved. This of course, has never been proved. No satisfactory measure of the intensity of labour or associated notions of fatigue and rest have ever been established.

That did not prevent claims being made that Bedaux was more than a payment system. Clayton told the production engineers that Bedaux's 'chief merit is that it is a system of management or organisation' and that systems like Bedaux 'are really

very elaborate systems of scientific management. It is difficult to understand why they are regarded primarily as payment systems' (1930-32:393-5). In America Bedaux was defended as a system which gave management the facts to prevent labour difficulties, a 'common denominator of constant value' for all human operations giving a true measure of human productivity (*Mechanical Engineering*, 1938). More recently Shimmin has repeated the view that Bedaux was more than a payment system; it was a 'means of production control' throughout the factory (1959:23).

It is hardly surprising given the claims to have discovered a new science of strain unknown to physiology, and the secrecy surrounding it, that Bedaux was not well understood. The *Times*, inspired by the name, described it as a French system of piecework (Sept. 10th 1930). More surprisingly, the ILO did not at first seem to understand how the system worked either. In a report on Bedaux for the TUC in 1932 the ILO suggested that it could not be scientific if 60 Bs an hour was a scientifically established standard, and 95% of workers were expected to produce in excess of that standard. The ILO concluded that 60 Bs must be an artificial measure set up to be exceeded (tuc/292/112/2, 9 June 1933). Littler repeats this argument and suggests that it represented an 'important inconsistency common to most neo-Taylorite systems' (1982:110). But this is a misunderstanding. Every piecework system depended on establishing a standard for a *normal* level of effort which a pieceworker could be expected to better. Bedaux was no different in this respect. But the frustration, scepticism and hostility which the combination of secrecy and science encouraged is easily understood. It was best expressed by W.F. Watson who wrote that, 'After wading through a mass of literature couched in scientific terms, accompanied by algebraic equations, tables and graphs, we are unable to discover the precise method by which the amount of time needed (to



machine the shaft), and the correct amount of energy thus expended, is assessed, or by what process the "laws governing strain" are applied to determine the amount of time necessary for rest and relaxation' (1932).

In fact, there was no real mystery about what the Bedaux company was doing, though Bedaux did everything he could to make it appear so and historians who have discussed the question since have sometimes perpetuated that image by making the system appear more complex than it actually was. Asked to explain the basis of the B unit, C. J. Carney, an American who served for a time as managing director of the Bedaux company, told his audience that it was based on experience: 'Mr Carney answered this question by saying that Bedaux was an arbitrary unit which had been gained by use and experience, and from the information that had been collected in past applications. Allowance for fatigue was extremely difficult for anyone to measure directly, but certain methods had been developed to ascertain its indirect measurement' (*Industry Illustrated*, Jan. 1936). It would be easy to conclude that Bedaux was one of history's most spectacular confidence tricks, and in a sense it was. But Bedaux was addressing crucial issues; the amount of work, its physical demands, the speed at which work could be done, the amount of rest needed, and the relationship between them. In other words, Bedaux was trying to develop a measure of the intensity of labour, something that came to be expressed through effort rating and relaxation allowances. And even if all attempts by post-war work study to validate effort rating failed miserably, there is no doubt that it addressed a fundamental problem in time study which had not been resolved by Taylor.

Time study is concerned with establishing 'a fair day's work', not simply finding out how long it takes a worker to complete a given task. Were it not so, the slow

worker would earn the same, or better bonus, for saving time on a job which took four hours, as a fast worker who took only three hours to do the same work. To put the problem another way, the question is what standard of output could be regarded as normal or average, and therefore what level of output would attract a bonus. Every system of payment by results, whether based on rule-of-thumb rate fixing or scientific time study, operates with some notion of the average, whether this is made explicit or not. Taylor declared that he had, 'in almost all cases, solved this part of the problem by fixing a task which required a first class man to do his best, and then offering a good round premium' (1947:175). The differential rate bonus scheme was based on this idea since it offered a reward for the first class man and no other. In an exchange with the chair of the House Committee investigating scientific management, Taylor defended his scheme on the grounds that everyone could be a first class man at something - a proposition greeted with deep scepticism. Gantt's task and bonus scheme offered a gradual build up of bonus to first class levels but the essential difficulty remained, of defining and measuring an average intensity of labour.

Taylor's stature and reputation is such that it is all too easy to use his work as the standard against which others are judged and usually found wanting. In fact, Taylor's methods were fairly primitive, something which has been disguised by the flair for salesmanship which Taylor clearly shared with Bedaux. The famous tale of Schmidt and the pig-iron experiment, for example, has been shown to be largely fiction. The rest periods which Taylor supposedly instructed Schmidt to take consisted of walking back from the railway car without a pig of iron. According to Wregge and Perroni, 'the rest periods that authors have been describing with such assurance for the past sixty years never existed' (1974). Bedaux's attempt to find a systematic way of defining and standardising a measure of labour intensity was



therefore a refinement of Taylorism of great practical potential. Instead of basing times on the first class man, or more commonly, someone thought to be an average worker, Bedaux offered a universal standard. 'The standard of effort he set up as normal', wrote P. K. Standring, a Bedaux engineer at ICI, 'is that expended in walking about on level ground at three miles per hour' (1934).

Its practical potential lay in the way in which Bedaux's standard was used. Post-war investigations exposed the scientific pretensions of effort rating and fatigue allowances (Desmond 1962; Bruckhart 1951; Belbin 1958). But Bedaux's standard for normal performance was still taken over by modern time study and can be found in the ILO's, *'Introduction to Work Study'*, defined as 'Steady, deliberate, unhurried performance, as of a worker not on piecework', an effort corresponding to 60 on the Bedaux scale and 75 on the 0-100 Standard. By comparison, a pieceworker giving a 'brisk, business like performance' is comparable to walking at 4 miles per hour, and corresponds to 80 on the Bedaux scale and 100 on the Standard rating (Grant 1983:43). This was Bedaux's most important legacy, not the laws of strain or the 'mysterious chart of relaxation allowances' (Kreis 1990:271).

A second important feature of the Bedaux system to which Standring also draws attention was Bedaux's 'base rate analysis'. 'The hourly rate of pay for any specified job', argued Standring, 'can be fixed in relation to the standard rate of labouring pay which obtains at the time'. The connection with the later development of job evaluation is obvious. In practice, and as a matter of policy, Bedaux engineers were usually careful to insist that rates of pay were a matter for the employer to settle with his workers or the trade unions. Base rate analysis was offered as an additional service which could be used to establish relativities, though it could also

be used to agree the basic wage itself (Ward, w/8/29-34/12, 26 May 1932).

Bedaux himself seems to have believed that equal pay for women was a logical conclusion. There should be a standard rate of pay, he argued, for workers capable of 'furnishing a standard daily production' and that this would 'demand readjustment of a considerable amount of rates, particularly in industries where women have been exclusively employed in the past' (1921:411-412). But Bedaux did not, as Downs seems to believe, provide 'a technical basis on which to abolish the old hierarchical arrangement of labour, by skill, age, and gender' (1990:49). Measures of labour intensity for the purpose of bonus schemes, or base rate analysis for the basic wage, were still related to the *class of work* which would attract different levels of pay.

In a critical appraisal of Bedaux, C. H. Northcott, Rowntree's personnel officer, noted that the claim to science rested on the calculation of a work-fatigue ratio which was, in turn, based on an unscientific estimate of effort or 'speed rating'. He welcomed what he called the Bedaux point system for labour measurement but argued that other systems did the same thing by converting efficiency achieved into a percentage of standard. 'The Bedaux system', he argued, 'is a time study system with little to distinguish it in its basis methods or results from any other system' (1932). Anyone who doubted this was invited to study the Haynes Mannit or the standard time system. Northcott's point is an important one. The B unit was no different in essence from the man-minutes or standard minutes of these systems. In the more familiar language of post-war work study, standard minute values express the basic time necessary to do a job, adjusted for effort, together with allowances for contingencies, fatigue and personal needs. And they provide the same standard measurement of different kinds of work for production control purposes as the B unit. If we continue to refer to the 'Bedaux System' it is only because Bedaux



represented an early example of modern work study in which the elements were presented in a particular way, not because there is much to distinguish Bedaux from any other work studied payment 'system'.

### **Bedaux and Management**

Bedaux was a management system, in as much as the time studies which supported the payment system served as a key element in production monitoring and control. But how far did Bedaux reach beyond the immediate control of labour to the organisation of production, to carry out wider changes in management methods which Taylor's mental revolution required?

The first thing is to put that question in historical perspective. Bedaux was operating twenty years after Taylor's death and in a context where much of what Taylor had demanded was coming about, albeit in a piecemeal, haphazard fashion. Companies without any conscious scientific management policy were planning and routing work from new planning departments, and had developed a range of management functions which had reduced or eliminated the autonomy of craftsman and foreman. As John Lee's dictionary noted, on the broader definition of scientific management concerned with the organisation of industry, 'those features of present day management which, in well organised establishments, are taken for granted, were conspicuous by their absence' in Taylor's day (1928:1059). We would not expect Bedaux to be making the same demands for total reorganisation that had got Taylor into such trouble.

At the same time, we might expect Bedaux to have had rather more impact on management organisation than the system seemed to offer. The ILO report noted that 'the Bedaux engineer does not change the method of working in any way'

(tuc/292/112/2, 9 June 1933), a point which the Bedaux company seemed to confirm in their pamphlet, *Bedaux Measures Labour*. The value of the system for monitoring costs, improving the utilisation of labour and establishing production control was stressed but so too was the pledge that 'Bedaux involves no sweeping changes'. The engineer 'adapts Bedaux measurement ... to conditions as he finds them... Physical layouts are not changed and there is no interference with existing methods and processes. Bedaux measures the effectiveness with which labour is used in connection with existing facilities'. The Bedaux organisation, it was said, does not concern itself with manufacturing methods, 'The Bedaux field is labour measurement and the Bedaux organisation remains within that field' (eef/237/3/1/235).

Categorical as that statement sounds there is evidence that matters were not so simple. In June 1933 Leslie Orr was writing to the engineering employers on behalf of the Bedaux company to correct the impression given by the pamphlet that the company was only concerned with labour utilisation and control; 'control is actually established by us in a number of even more important directions, covering, for example, machine utilisation, reduction in overhead charges, better utilisation of primary materials, and also plant layout and planning' (eef/237/3/1/235, 27 June 1933). The Bedaux company had been shaken by the resistance of engineering workers and Orr was trying to reassure employers who were backing away from Bedaux as a consequence. But Bedaux's own propaganda, as well as the experience of workers to whom it was applied, had firmly established the reputation of the company as being solely concerned with intensification of labour and 'speed-up'.

A Labour Research enquiry into Bedaux argued that the focus on labour intensification followed from the limited scope of economic rationalisation in



Britain. There were three forms of rationalisation. The first relied simply on the intensified exploitation of human labour power; the second on new methods of production, including new plant and standardisation, while the third form of rationalisation introduced modern, scientific methods of production characterised by conveyors and speed-up. Bedaux belonged to the first type which 'is most commonly used, especially in a country like Great Britain where the capitalist class is not prepared to find the necessary amount of constant capital....' (Glading 1934:3). This view of Bedaux was reinforced by the claims made for the system's effects on earnings and output. Figures produced by the National Industrial Conference Board (1930) compare the effect of a number of systems

**Table 10      Bonus Systems - Earnings and Output**

	Taylor	Halsey	Gantt	Piecework	Bedaux
Median Increase					
Production	25	40	32	30	50
Median Increase Earnings	20	23	20	25	20
Median Decrease in Unit					
Costs	17	20	20	21	20

Interestingly enough, they show Taylor to be most generous with earnings at 80% of increased production, and Bedaux to be the least generous with earnings at a mere 40% of the increase in output. It has to be said that the National Industrial Conference Board offered these figures 'for what they are worth' since it was unclear what type of work had been measured and their accuracy could not be guaranteed. But the results for Bedaux would have confirmed the view which had been formed of the company.

Bedaux himself was largely responsible for this. Fleming has testified that the work for Lyons in 1926, extending throughout the company, to bakeries, laundries, hotels, tea shops and factories, was the first diversification into production planning and costing (Fleming, undated). But Bedaux's 'Code of Standard Practice' laid down a firm policy of non interference with plant policies except where they were in direct conflict with fundamental Bedaux practices. In particular, the Code stated that 'B values to be set to provide the minimum number of B's required to perform the operation with the facilities at hand, but no suggestions to be made as to design or redesign of jigs or fixtures, purchase of new equipment, movement of any machines or re-arrangement of departments' (Bedaux 1928). However, there was opposition within the company from the beginning to such a narrow policy. Carney says he tried 'unsuccessfully to obtain Mr Bedaux's approval to modify the Bedaux system to meet Britain's basic problem of high unemployment' in order to ease relations with labour (Carney, undated).

But by the mid 1930s, according to the Bedaux's head of research, Mildred Brownlow, militant labour opposition to work study was forcing the company to diversify into 'less inflammatory' areas such as plant layout, quality control and so on (Brownlow, undated). In 1936 Bedaux, increasingly discredited after his trip to Nazi Germany and an embarrassment to the company, was persuaded to allow the Bedaux company to go public, and two years later, AIC emerged to provide a more acceptable public face. At the same time company policy was shifting. 'Up to the formation of AIC', wrote Fleming, 'progress in diversification of the company's work had been severely limited by Mr Bedaux's insistence on a restriction to the so-called "Bedaux System", covering labour, cost control and incentive schemes. Proposals for change in method were frowned upon' (Fleming, undated). Progress was more rapid after the war and by the end of the 1950s, specialist divisions had



been established for executive selection, marketing, operational research, electronic data processing, and even industrial and human relations.

Even before the war, according to Fleming and Mildred Brownlow, 'There had been escapes from the strict boundaries of work study into material economy, budgetary control, operator training, plant layout and preventive maintenance scheduling' (Brownlow, undated). According to the time study officer at Peak Frean, motion study did not form part of the Bedaux application at that firm, though conflict between local managers and Bedaux engineers about set-ups suggest that Bedaux advice was not confined to simply measuring labour (Ward, w/8/29-34/12, 21 April 1932). At a number of firms Bedaux applications clearly involved extensive alterations to machinery. Coopers, the Glasgow biscuit manufacturer, installed £12,000 worth of new equipment on Bedaux's recommendation, and at Wolsey, expensive and extensive alterations to shop equipment were made in a shop 'already considered to be one of the best in the trade' (lab2/2061/ir 1441/1938, J. B. Gailbraith 3 Oct. 1935; Ryder 14 March 1935). Not that Bedaux attention to wider engineering questions always proved satisfactory. Wolsey's joint managing director's enthusiasm for Bedaux was reported to be more subdued than it had been, and Coopers were positively dissatisfied. Despite claims made for the expertise of Bedaux engineers, 'a member of staff would often find himself studying work on machines he had never seen before, with materials whose characteristics were really unknown. One who was making a survey in a bakery was worried to see "rolls" going into the ovens, but only loaves coming out, not realising that the dough expanded to such a degree' (Brownlow, undated). At ICI Bedaux claimed to have special techniques for the overhaul of engineering maintenance work, focusing primarily on the scheduling of work, and only secondarily on incentives. Work begun in 1936 was abandoned a

year later when it became obvious that 'the Bedaux company had no novel techniques applicable to engineering maintenance', and relations with Bedaux were terminated in February 1937 (Faraday, undated).

Despite such criticisms Bedaux continued to make ground, and ICI was one of its most important customers. According to Faraday time study had been used in the company from the early 1920s but received a considerable boost following the establishment of the Bedaux company. First employed in the explosives division in 1929, the system spread to paper goods manufacturing in 1931, and to the paints and dyestuffs divisions by 1933. A Bedaux engineers committee for ICI was formed in 1932 and by 1939 between 10% and 25% of payroll in the dyestuffs, leathercloth, lime, metals and Nobel and paints divisions, were on time-studied incentive schemes (Faraday, undated). And in 1947 ICI appointed R. M. Currie, a Bedaux trained expert and the most prominent post-war advocate of work study, to be responsible for work study throughout the company.

Bedaux was indeed the 'Taylorism of the Great Depression', with a single-minded focus on increasing productivity by increasing the intensity of labour. The chief means for doing so was installing a payment scheme in which rigorous time study screwed down as low as possible the time allowed to complete a job, backed up by close monitoring of results and published performance comparisons. As Bedaux's personal grip on the company loosened, more broadly based and less overtly oppressive applications became possible, driven in large part by the need to accommodate worker resistance. Scientific management in Britain between the wars was not confined to Bedaux, but Bedaux was certainly the single most important example of a more general phenomenon.



## **The Influence of Bedaux**

Kreis says that Bedaux took Britain by storm (1990); Littler that with 250 firms using Bedaux by 1939, including many industry leaders, 'Bedaux became the most commonly used system of managerial control in British industry' (1982:114). Both are wide of the mark but Batstone et al are not right either, to dismiss Bedaux as a marginal development (1987:9).

Figures produced by Kreis from the Bedaux archive actually show that the post-war period is the key period for both the growth in number and range of Bedaux applications. The number of British firms using Bedaux, year by year, grew from 3 in 1926 to 30 in 1931, falling thereafter (with the exception of 1934), to a low point of 11 in 1936. Growth was fairly steady after 1936, but the 1930 level was not reached again until 1945. The number of firms using Bedaux by sector shows a concentration in textiles, chemicals, and food, drink and tobacco in the period before the war, with a total of 178 applications in the period 1926-1939. In the period 1939-1949, the total number of applications grew to 388, and while textiles remained the most important sector by far, metal manufacture and mechanical engineering had assumed a new importance (1990:344).

This picture is confirmed by figures produced by Inbucon for the period 1923-1965 showing company capital, numbers of staff and assignments. Taking one measure alone, the number of new assignments, which doubled between 1931 and 1943, increased more than nine times before 1959 and one and a half times again in the next six years.

The problem for Bedaux in the 1930s was the hornet's nest of opposition which the system encountered on the shop floor. Fleming described the years between 1930

and 1940 as one of stagnation. The company had achieved an annual turnover of £150,000 in five years of rapid growth to 1931, but turnover remained at that level until 1939, doubling by 1943, and reaching one million pounds in 1955 (Pleming, undated). It was the backlash from the Bedaux labour troubles in America as well as strikes in Britain which, according to Pleming, 'caused a reduction in the volume of business we were doing'.

**Table 11      Bedaux (Inbucon) 1923-1965**

Year	Capital	Staff	New Assignments	Total Assignments
1923		1	1	1
1926		2	1	1
1931		40	20	50
1936	300,000	50	30	280
1943		100	40	540
1959	600,000	300	380	3,200
1965	680,000	355	600	5,500

Source: Inbucon Ltd, Brownlow Papers

But Bedaux was more than a marginal phenomenon in the 1930s. And its post-war growth testifies to its key position in the business. Twenty years after the name Bedaux was dropped, time-study journals routinely carried advertisements for 'Bedaux trained men' (*Time and Motion Study*, Jan. 1958). The influence of the company can be measured in other ways too. Bedaux engineers took up leading positions in industry, like J. J. Gracie, director and general manager at GEC,



Witton; W. T. Rivitt at Kagan (Gannex) Textiles; James Whitehead at David Browns and R. M. Currie, who trained at AIC before joining ICI. All the principal post-war consultancies had their origins in British Bedaux including Production Engineering Ltd (1934), Urwick Orr (1934), and Personnel Administration (1943). Together with Inbucon, these four, with a thousand experienced consultants working for them, accounted for 75% of all consultancy work in 1956 (Brownlow, undated; Tisdall 1982:9).

### **Piecework, Bedaux and Labour**

At Messrs Rees Roturbo in Wolverhampton in 1933, AEU members were resisting the reintroduction of piecework. 'Some time ago', reported the AEU Divisional Officer, Dempster, 'this firm discontinued piecework, a decision we contested ...' (AEU Dec. 1933). Roturbo's engineering workers may have seemed hard to satisfy but the particular form of payment constituted only the immediate issue. Behind that lay the larger questions of control and insecurity, of the amount and type of work to be done, the pace at which people were expected to work as well as the pay to be earned. There were post-war strikes against piecework but the issue between the wars was much less frequently a root and branch opposition to piecework than a struggle around the conditions under which it would be worked, including the linked issues of deskilling and the machine question. At Ransome and Marles Bearing Co. in Lincoln in 1926, the AEU protested that the firm *refused* to introduce a piecework scheme for toolmakers and maintenance workers who earned only 57/- while semi-skilled men on piecework were said to average around 60/- with some getting as much as £7 (eef/237/3/1/231, 10 June 1936). And in a classic reversal, the AEU's General Secretary, J. C. Little, who had himself been the shop stewards convenor at Elswick before the first world war, wrote to Vickers at Barrow in 1933 to protest the withdrawal of a premium bonus scheme

for shipyard mechanics and maintenance men, asking the company to furnish reasons for 'this drastic move' (eef/237/3/1/206, 16 Sept. 1933).

One of the key issues was complaints of 'speed-up' which were common to piecework and Bedaux schemes alike<sup>3</sup>. The focus of the 1929 strike at the Austin was the new grading scheme and earnings. Piecework prices were again an issue in the 1936 strike, but on this occasion, according to the *Town Crier*, it was a revolt against speed-up, 'the logical expression of workers who for months have endured the effects of speeding up' (20 Nov. 1936). A student who had visited the plant at Longbridge wrote in similar vein, 'My real astonishment is at the time the Austin workers have stood imposition after imposition, and constant speed-up.

Mechanical repetition of a few actions is the life of most of the Austin workers.

Austin tries to make every man approximate as nearly as possible to the machine he works at' (*Town Crier* 27 Nov. 1936). At Dunlop 6,000 workers struck in 1925 over 'speeding up in various departments' (AEU Nov. 1925). And at Rolls Royce in Derby in 1938 a mass meeting held in working hours demanded the withdrawal of time and motion study experts, a halt to the introduction of boy labour and sub-contracting and the de-grading of jobs. The *Times* reported the AEU official as denouncing the threat of the Bedaux system and 'was loudly cheered when he declared his readiness to lead a strike against any further such attempts' (15 Feb. 1938). It is not clear whether it was in fact the Bedaux system which was being introduced, but that did not matter much to the convenor and shop stewards who 'were unanimous in condemning time and motion study as being as bad as the Bedaux System' (Frow and Frow 1982:124).

Workers of all kinds were affected by time study and Bedaux; men and women, skilled and unskilled. The duty of the rate fixer, wrote F Builo in *Cassiers*, was to



split a job up into as many operations as possible. Skilled mechanics in the new production processes would make the jigs and fixtures for others to use, 'the mechanics who do not have this advantage will, perforce, have to take their place amongst the semi-skilled operators' (1922:156). Many of them did. Quarrels about piecework were often linked to complaints about deskilling in ways that were often difficult to unravel. At Howard and Bullogh Ltd in Accrington certain machining processes were reorganised in 1930 to eliminate some of the less skilled work which was then given to apprentices. The job was retimed and the time allowed cut by 25% which, in turn, led to complaints about earnings and of inadequate training for apprentices (eef/237/3/1/214, 12 Dec. 1930). At Boulton Paul in Norwich in 1931 the Bedaux system of payment led to a strike and arguments about the lack of mutuality in fixing prices and failure to earn 33.3% bonus, as well as the breaking up of jobs. The engineers alleged that 'the Bedaux system arranges for a wide range of what are termed "operation rates", and the various classes of labour are split up into grades, each grade having its own base rate'. For its part the company conceded that 'the improved organisation would involve the breaking up of jobs so that energies might not be dissipated' but argued that would happen with any reorganisation and would, in any case, increase the demand for craftsmen (eef/237/3/1/235, June 1931).

Skilled workers fought back in a variety of ways. 'Bench operations would become extraordinarily complicated and panels would be bashed as never before...Rather more difficult to counteract than the obvious effort to impress, were problems involved in dealing with the co-operatively unhelpful' (Brownlow, undated). At Boulton Paul in Wolverhampton, in a long running fight about piecework earnings and dilution, AEU members adopted a tactic of using management's own organisation against it, 'That no man shall manufacture tools, fixtures or appliances

in connection with his work that are not indicated by the Planning Department, without first receiving instructions and due allowance being made in connection with same' (DSO/23/22). In this case, management quickly conceded time and a quarter for making all tools.

Employers were wary about the reactions of skilled men. Piecework was introduced into a number of toolrooms, including those at Austin and Lucas, but the Engineering Employers Federation told its members in 1934 that, although they had a right to introduce it, 'the Federation would not advise the enforcement of a piecework system where the basis of mutuality appears to be entirely lacking' (EEF Minutes 19 Dec. 1934). In the same year, the London Association said they knew of only one firm 'officially' using Bedaux, and then only for semi-skilled and females, owing to the opposition of skilled men (eef237/3/1/235). In 1937 G. M. Hall, speaking on time and motion study, told an audience of production engineers that he had practically no experience applying time and motion study to skilled men, 'our applications up to the present having been limited almost entirely to unskilled labour - both male and female' (1937:610)<sup>4</sup>. Even at Metro Vickers in Manchester, where Anne Shaw had studied men and women, union and non union, it was mainly applied to women and used 'not so much on union men ..... We have an agreement with unions in our factory not to film members of the union without special permission'. And the company had never needed to ask for it (*British Management Review* July-Sept.. 1938).

Skilled men have occupied the limelight in the discussion of Taylorism because a real, independent, basis for skill constituted an obstacle to the reduction of all labour to general, abstract labour, and because the so-called craft mode of production could be seen as a denial of capitalist rationality and an assertion of the



dignity of labour (Hinton 1973; Montgomery 1989); because the skilled metal worker has formed the backbone of socialist and communist movements (Hobsbawm 1984) and, perhaps, because 'we find ourselves oddly attracted to the pre-industrial skilled artisan, and a little afraid to learn what contemporary workers really think and feel' (Lynd 1988:100; Monds 1976).

But a changing labour process changed the lives and work of women, and of unskilled and semi-skilled men, as well as craftsmen and managers. The new tools in engineering created opportunities for the labourer, and the new light engineering industries, new openings for women. If this was in some senses an upgrading of labour, it was not necessarily experienced as such, if only because the new occupations became an immediate target of the efficiency engineer.

The assembly line workers of the new industries were 'almost exclusively women', their work as subdivided and mechanised as it was possible for it to be (Glucksman 1990:147). Women workers had long been the subject of work related research. The IFRB, and its successor, the IHRB, devoted a number of reports to women workers from metal polishers to chocolate packers. And of nine motion study case studies reported by Anne Shaw in 1960, covering a variety of industries and occupations, seven involved women and while the other two did not specify, they were almost certainly women too. Taylor studied women workers as well, reducing by 50% the numbers required on final inspection at the Simmonds Company in 1897 (Nelson 1980:69). And if Taylor's first encounter with labour was his struggle with his fellow machinists, his most often repeated stories concerned unskilled manual labour such as loading pig-iron and shovelling. Taylorism was never a system designed exclusively to attack craft; it was always a means of organising production and directing labour of all kinds.

Women led the way in struggles against Bedaux. At Rover, in Coventry, women trimmers struck against the introduction of the Bedaux system in August 1930, to be followed out by skilled trimmers after thirty four NUVB members had been disciplined for refusing the women's work (eef/237/3/1/235). Meanwhile, at the Rover plant in Tyseley, Birmingham, AEU members in the grinding department reported the system working satisfactorily and despite subsequent complaints and reference of the matter to the Executive Committee, no action was taken (AEU Sept. 1930; AEU March 1931). At Lucas in 1932 women workers were reputed to have chased the Bedaux engineers onto the roof and threatened to throw them off. When the system was temporarily withdrawn the company said the atmosphere 'brought back recollections of Mafeking and Armistice Day' (Lucas Minutes 17 Feb. 1932). The Ministry of Labour noted that 'The workpeople left the shops singing and making a good deal of noise but otherwise were quite orderly, although there was some talk of waiting about for the Bedaux engineers ...' (lab2/2061/ir1441/1938 Ryder 30 Jan. 1932). The AEU interviewed Lucas about Bedaux but took no action since few members were affected (AEU Jan. 1932). At Amalgamated Carburettors in the same year, 250 women and girls on machine work and assembling struck alongside 150 toolsetters and viewports against Bedaux. When the firm issued an ultimatum to return or be sacked, 'The men resumed work ... but the women and girls remained out' (lab2/2061/ir1441/1938, 4 Feb. 1932).

Unskilled and semi-skilled men, very often unorganised and refusing the intervention of trade unions, also fought the new piecework systems and the efficiency engineers. The Austin strike against the new grading system was conducted by unorganised workers under the leadership of an ex-miner from Wales



(*Birmingham Post* 27, 28 March 1929). The 1936 strike against cuts in piecework prices and speed-up was similarly 'unorganised' (*Birmingham Post* 13 Nov 1936).

### **The Impact of Worker Resistance on Bedaux**

The struggle could be complicated and the result uncertain. At the ICI firm, Scottish Dyes in Grangemouth, the workers were divided. Bedaux seems to have been introduced originally in 1931 against the opposition of local TGWU officials but with the co-operation of some on the works committee. Those working the system enjoyed higher earnings and the TGWU told the TUC 'That while on principle the men objected to the system, they desired to retain the Bedaux earnings and that the system was popular to that extent and acceptable to the majority of those operating it' (tuc/292/112/2, 28 Dec. 1932). It was also pointed out that speed-up and reorganisation was taking place in departments not on Bedaux and without increased earnings. Nevertheless, hostility to the system continued to build. In February 1932 Bevin negotiated an increase in the Bedaux premium to 90% and, in return, pledged that the TGWU would not support a strike should one occur. The following month 300 process workers struck, without union support, after the man leading the struggle against the Bedaux system was dismissed. Thirty men subsequently left the TGWU to join the break-away Scottish Transport Workers (lab2/2061/ir1441/1938, 10 March 1932).

The balance sheet in the struggle against Bedaux showed considerable labour gains. At Henry Hope the defeated strikers returned to work with only a pledge that there would be no extension of the Bedaux system until local conferences had been held. But the firm found the situation unsatisfactory nonetheless, reporting that the fifty men working on Bedaux 'are working at only about half the speed they did before the strike, and in so doing are receiving the moral support of the

other men in the shop' (EEF Minutes 29 June 1933). The EEF estimated that 10% of strike days lost in 1933 were due to time study and work measurement and it was said that 'there was scarcely a Federated firm which has introduced the Bedaux system without having a stoppage of work'. A 1934 EEF report on Bedaux strikes noted a dozen major strikes across a number of industries between 1930 and 1933, involving more than 8,000 workers (eef237/3/1/235). The EEF promptly disowned Bedaux.

The Management Board of the EEF, meeting in July 1933, resolved that the Federation could take no responsibility for trouble which arose from the introduction of the Bedaux system, since the Federation agreements demanded that any system be agreed directly between the management and its workforce and not by outsiders. This stance was not, however, entirely the consequence of strikes. It was also influenced by a certain conservative insularity which was increasingly the hallmark of the organisation. The EEF re-issued an earlier circular from 1928 which advised members to resist inducement to 'institute in their works systems of payment by results which do not conform to the terms of the national agreements which are in existence or the practices observed between the Federation and various trade unions' (EEF Minutes July 1933). Moreover, this attitude was sustained for more than another decade. In 1945 members were advised that consultants have 'on occasion failed to have regard for the psychology of the British workman, and have made ostentatious and unnecessary display of the stop watch in their assessment of times' (EEF Minutes 28 June 1945). While the EEF had no desire to limit the use of consultants, it was stressed that piecework times must be agreed with members of the firm's own staff.



Where Bedaux was introduced against serious opposition the result was often the sort of modifications to the scheme which brought it closer to other piecework schemes backed by time study, where a degree of 'mutuality', that is mutual agreement between the worker and the employer, operated with respect to time allowed for a job. At Taylor Bros. in Manchester, the ISTC reported that they had secured modifications 'which are considered to give satisfactory results'; the Amalgamated Weavers claimed to have destroyed its undesirable features in the Lancashire Cotton Corporation Mills so that 'the scheme is not now the Bedaux system at all'; and the Amalgamated Hosiery Union at Wolsey told the TUC that the system had been modified after the strike at Wolsey in Leicester and now had some 'good features'. The Wolsey agreement provided that studies would be done on good, bad and indifferent work to find a fair average; that the premium would be 95%; and that values, once established, 'would be altered from time to time as conditions varied, by arrangement between management and the worker' (tuc/292/112/2).

Will Thorne described the settlement of the strike at Venesta in 1933 as 'one of the best in the country' (tuc/292/112/2, 22 May 1933). The Bedaux experiment in the tin-foil department would continue but a joint committee would be established to study the operation of the system and a worker was to be trained in the Bedaux system to act as a representative of the men. There would be no extension of Bedaux without the agreement of the Joint Committee and any difference arising would be referred to a conference of the company and the unions. In reality, it was, at best, a qualified victory for the strikers who wanted rid of Bedaux altogether and who rejected similar proposals two weeks into the strike. But the Joint Committee achieved some modest concessions in the short run; surplus labour would be transferred to a lower rated job and any reduction in rates would be spread over

twelve months. In the longer run, a degree of control was conceded to the union and shop floor representatives and led to the permanent establishment of a Works Council at the company (Vanesta/mss97/5/17).

The strikers at Venesta's Silvertown works were predominantly NUGMW which claimed 800 members, 40% of them women, among the thousand or so workers engaged in the production of plywood. But the strike took the union as much by surprise as it did the company. The local NUGMW official had feared a strike over Bedaux and was discussing his worries with the Ministry of Labour when a NUGMW shop steward acted after seventy men signed a 'round robin' demanding a stoppage if Bedaux was not withdrawn. Two weeks later, on 19th April, Venesta offered a joint committee to review the Bedaux experiment and a guarantee that 'no further alterations in wages or working conditions shall be made pending the result of the work of this joint committee, or without its consent' (lab2/149/1r404/1933). Put by the union without recommendation to a mass meeting, the formula was overwhelmingly rejected. Feeling was running high, fuelled by fears of speed-up and job losses. On 27th April the strike was still solid and on the 29th, after strike breakers were introduced by the company, police were called to disperse a crowd allegedly throwing stones and bottles. On 1st May strikers slipped on board a train carrying scabs away from the works, the communication cord was pulled when the train entered a tunnel and a fight ensued. Police rushed along the track to intervene 'but several men were injured'. The following day mounted police were required to escort the scabs to the station, which was also under guard.

While strikers battled police and scabs, the union was searching for a solution. The NUGMW president, Clynes, wrote expressing an interest in the dispute, offering



his services as a 'disinterested person' and seeking a meeting with company directors. Early in May, according to Ministry of Labour reports, Clynes told the company that the NUGMW 'were not definitely opposed to the Bedaux System of work measurement as such', and after further exchanges about the continuation of Bedaux time studies in the tin-foil department, a conference between the company and the union agreed the terms of settlement which were accepted on 15 May at a mass meeting, by 604 votes to 199. Seven hundred employees returned. Those who were displaced by strike breakers would be given preference for vacancies as they arose until reinstatement was complete.

Following the strike relations between the company and the union, and the union and Bedaux, grew considerably closer. The report of the joint committee established following the strike noted that there may be a difficulty in extending Bedaux to the packing case makers, but according to the Ministry of Labour official most closely associated with the negotiations, A. G. V. Lindon, the NUGMW was willing 'to supply the company with all the woodworking machinists that may be required in the event of the packing case union withdrawing its members'. As for Bedaux, the company had made changes to its system at Huntley and Palmer after discussions with the NUGMW, even though the union had no members there. 'As a matter of fact', observed Lindon, 'it does seem that Messrs Charles Bedaux and Company are prepared to do almost anything with the Bedaux system of work measurement in order to overcome trade union opposition and clear the way for an open market for themselves' (lab2/149/1r404/1933, 25 Oct. 1933).

It is clear that worker resistance was an important factor in shaping the way the labour process developed between the wars. Even the dreaded Bedaux system

could become the subject of collective bargaining. These were real and substantial gains; elements of control over aspects of work without which the 'dehumanized prisons of labor', which Braverman saw Taylorism creating everywhere, would have been a lot more oppressive than they actually were (1974:233). But it is equally clear that the worker resistance which we have described, a struggle conducted for limited aims around immediate demands, was unable to change in a fundamental way, the capitalist labour process. And this is true not just in the general sense that the process remained exploitative but true also of the particular historical forms of capitalist development. Bedaux, or more generally, the developing practice of work study, could not be rooted out. In the period after the second war those processes spread faster than ever. They did so precisely because shop floor struggles had wrung important concessions from the efficiency engineer; because social and economic conditions after the war were less threatening; and because work study now attracted the positive endorsement and support of the workers' organisations, the trade unions and the Labour party. We examine below the relations between the unions and Bedaux before outlining the post-war history of work study.

### **The Trade Unions and Bedaux**

Laura Lee Downs has suggested that the TGWU was soft on Bedaux because the leadership was 'enchanted by the prospect of joint participation in the project to revive industry through rationalisation' (1990:62). The union would fight 'unreconstructed Bedauxism' but were prepared to accept a coercive work system for the compensation of equal pay for women. This judgement is a little confused since it begs the question of how 'coercive' the system remained if it were to be 'reconstructed'. At Rover the TGWU succeeded in ensuring that operators received the whole of the bonus, and 'more important, the union succeeded in



shifting the establishment of B allowances (effort norms) away from Bedaux's technocratic "experts" and back into the employer-employee negotiating arena' (Downs 1990:63). The terms of settlement could not have been clearer on this point. It was stated that 'B values shall be treated as piecework prices and dealt with under the recognised rules of procedure' (eef237/3/1/235). The local EEF official was outraged because women were guaranteed a minimum payment of £2 15s when the guaranteed time rate for women usually lay between 26s and 31s a week. The women might have been less than pleased to note that the point at which Bedaux premiums *began* to be earned was established at the output level previously averaged, that is to say, the previous piecework effort became the new base line. What Rover had agreed was a piecework system in which prices were established with the use of time study, and a high wage offered in return for demanding output norms. If the resulting work system was 'coercive', and it could reasonably be described as such, that scarcely distinguished it from practice elsewhere.

The TGWU's commitment to rationalisation certainly provided the union with a strategic orientation that made the adoption of such agreements easier. The union had supported the resolution endorsing rationalisation at the Mond-Turner conference in July 1928 which included a commitment to the scientific organisation of labour. And, despite some rivalry between Bevin and Citrine, it endorsed the position taken by the latter who argued that trade unions could no longer rely on a simple defence of trade union interests, much less a revolutionary policy. The unions, he argued, 'should actively participate in a concerted effort to raise industry to its highest efficiency by developing the most scientific methods of production...'. and seek for themselves a wider role in industrial administration and economic policy in return. On this view, scientific management opened up 'A wide field of

fruitful negotiation, with numerous possibilities of mutual agreement' (Citrine 1927). The TGWU agreement at Manders introducing the forty hour week seemed to fulfil this prediction. The *Daily Herald* welcomed the agreement as 'the rational way of going about what is not merely a Wolverhampton problem, but a national problem and it deserves to have national influence' (*Green Can* Oct. 1932).

But the willingness to accept rationalisation, to seek an accommodation with what Citrine called the new industrial order, also reflected the fundamentally pragmatic character of trade unionism, formed long before the vogue for rationalisation. Other than at the most extraordinary times, trade unionism is dominated by immediate issues and short term, limited, realisable goals. Even revolutionary members of the unions have been drawn into a reformist practice, concessions made, compromises reached, deals struck, because on a day to day basis this process was inescapable. (Hobsbawm 1976a). Trade unions have sought to regulate the labour process not transform it; to identify and struggle for the discrete interests of the worker as worker, rather than as producer or citizen. Nor has this been only a trade union position. Communist party members led the fight against Bedaux and speed-up in general, but socialists of all kinds were receptive to the argument that scientific management, if scientifically managed, was progressive<sup>5</sup>. Citrine only echoed the argument, put ten years earlier by Sidney Webb, that scientific management was perfectly acceptable if its introduction was negotiated and agreed (1917).

Richard Price's phrase about the way in which 'the labour presence in society has worked through a constant series of negotiations and accommodations' to create new social and political structures, which are themselves transformed in turn, describes this process exactly. But it ought not be taken to mean, as Price implies,



that 'a vision of the working class as the carriers of an alternative social and political organisation' is necessarily confining (1986:12,3). Trade union struggle around the labour process has not been revolutionary but the constant series of negotiations and accommodations it has involved have only served to confirm the fundamental and irreconcilable antagonism at the heart of the employment relationship, expressed in the struggle over a fair day's pay for a fair day's work. The forty hour week at Manders, equal pay at Rover, a works council at Venesta, cleared the ground for an accommodation which was simultaneously a tribute to worker resistance and an illustration of the limits of trade unionism (Anderson 1967; Hyman 1971).

If we return to the series of negotiations and accommodations as they developed, historically, concretely, in the 1930s, it is clear that the unions were shifting rapidly away from the view that Bedaux, or scientific management in general, was a fundamental threat to the worker. The general secretary of the Leather Workers wrote to the TUC about the introduction of Bedaux at Wood and Sons in Gunnersbury, describing the system as 'rotten, and designed against the worker ... At the moment we are advising some cussedness inside the firm...'. The TUC's advice was to negotiate, 'As we understand it, the Bedaux system is simply a particular method of payment by results based upon a certain method of work measurement' (tuc/292/112/3, 15 Feb. 1934). As such its precise effects would be determined by the outcome of negotiations.

The TUC pamphlet on Bedaux, published the previous year, repeated the ritual criticism of payment by results involving the timing of operations, unlimited speed-up and overdriving, but immediately moved on to establish a *modus vivendi* with Bedaux. 'No support can be given to any method which reduces the worker to the

status of machines. Apart from this general objection, however, which applies to all such methods, it would appear that Bedaux is capable of being applied, in a manner, and with modifications, that may make it less harmful than many other systems' (tuc/292/112/2). The AEU also registered fundamental objections at the same time that a route to a negotiated accommodation was indicated. The editor of the AEU journal noted that Bedaux was 'task work of the most obnoxious character, limiting freedom and individuality to the lowest possible minimum'. But the next sentence opened up a different kind of perspective, 'The system of payment to which we refer allows of no mutuality in respect of the time allowed for doing any portion of the work, but is arbitrarily fixed by a time recorder' (AEU May 1932).

The Bedaux company was delighted with the pamphlet, which they ought to have been since Milne Bailey at the TUC had worked closely with Leslie Orr from the Bedaux company to ensure that the Bedaux point of view was accurately expressed. They were equally pleased, according to one Bedaux official, with Moulden of the Hosiery Union and Ernest Bevin of the TGWU, being 'of the opinion that in any particular case they can satisfy the workpeople if Mr Bevin is concerned and that a bit of pressure from the union is rather a good thing in many cases because manufacturers are rather too greedy ...' (lab2/2061/ir1441/1938, Ryder 6 March 1934). In the changed conditions of post-war Britain, relations grew even closer. In 1961, Ted Fletcher, the secretary of the TUC Production Department, joined AIC as a divisional director and became the Industrial and Human Relations advisor to the Inbucon group. And according to Brownlow, 'No fewer than nine trade unions employed AIC to advise on their administrative structures and internal procedures' (Brownlow, undated). Ironically, it was the struggle of the women and men on the picket lines against speed-up in the 1930s,



wringing concessions from employers and efficiency engineers, that laid the basis for this particular accommodation, though it is one they would have found difficult, if not impossible, to understand.

## **Conclusion**

A number of conclusions can be drawn from the inter-war experience of payment by results schemes, and the Bedaux system, reviewed in this chapter. First, if the modern techniques of time and motion study were not widely used outside the mass production plants (Hunt 1951:60), more rigorous time study practice was spreading as criticism of premium bonus standards increased and premium bonus schemes declined. Moreover, companies like Austin, which combined sophisticated production engineering with time study and payment by results, were doing nothing fundamentally different from Bedaux at Vanesta or ICI. Bedaux was distinctive in the rigour of its time study standards and methods, and more influential in Britain than any other variant of scientific management practice. Indeed, according to one Bedaux engineer writing in 1966, 'in the field of work measurement, and particularly, of time study, present day practice probably owes more to Bedaux than to Taylor' (quoted in Kreis 1992:168). It is still important to see that it *was* only a variant and cannot be identified with scientific management itself.

Secondly, it is suggested that no general case can be made for the idea that British employers' reliance on piecework was either cause or consequence of a failure of managerial control. Indeed, it is quite clear that the inter-war preference for piecework over premium bonus was associated with a greater degree of managerial control over the effort bargain exercised through more sophisticated time-study techniques. Piecework could lead to a loss of management control but did not necessarily do so. Nor, incidentally, did Taylorist schemes like Bedaux guarantee

that control would last if it was established. Phillips introduced the Bedaux system into their Mitcham plant in the early 1930s but by the late 1940s there was increasing management dissatisfaction with the scheme. The catalogue of complaints included distortions to the wages structure, the creeping effect of small method changes in undermining work study values, and a tendency for supervision to rely on bonus incentives rather than 'looking for method changes' (Westwood 1965).

Thirdly, it is clear that the skilled man was not the only, nor perhaps even the principal target, of Bedaux. Women trimmers at Rover, assembly workers at Lucas, and chemical processes workers at ICI plants, all confronted the Bedaux scheme for labour management as well as the AEU's skilled men at Boulton Paul at Norwich and Rover in Birmingham. Time and motion study, whether practised by Bedaux or any other efficiency engineer, tended to undermine skill. But it did not liberate those 'upgraded' from labouring to semi-skilled tasks. The reconstitution of the labour process was experienced on all sides as an intensification of more regimented labour and resisted. In Britain between the wars, it was the semi and unskilled worker who was first in line for the Bedaux treatment and who fought back hardest.

Finally, we have seen that worker resistance was matched by 'worker accommodation' to the new management systems and patterns of work organisation. Resistance was fiercest on the shop floor and accommodation more pronounced in the trade union office but both were present and influenced the final shape of the labour process. Skilled men found it easier to bargain about the *treatment* of subdivided labour than resist subdivision itself. Trade unions found it easier to address issues of speed-up and the distribution of bonus earnings than the



way in which systems like Bedaux tended to reduce labour to 'the status of machines'. In itself, this should not be surprising. But the speed with which trade unions came to terms with Bedaux is noteworthy, if only because what began in the 1930s as a cautious willingness to negotiate efficiency schemes, turned into a positive endorsement of work study in the years following the war.

This chapter has shown how time and motion study in general, and the Bedaux system in particular, became more firmly established in the 1930s. But the most rapid growth for both came after the second world war, with work study reaching a peak of influence in the 1960s. In the postscript which follows, the post-war history of industrial engineering is sketched to complete the picture of the development of scientific management in Britain.

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## Notes

<sup>1</sup> The Institute of Cost and Works Accountants commented on Ministry of Labour figures that 'It is interesting to observe that payment by results methods are in greater use for skilled workers than for unskilled workers, and that women are paid by such systems more frequently than men' (1954:34)

<sup>2</sup> Fenlon says that scientific management was adopted more slowly and less extensively in Britain than in the USA but, writing in 1939, he believed that time and motion study had now 'been very widely adopted' (1939:13)

<sup>3</sup> 'Speed is the essence of present day industry' wrote the Chief Inspector of Factories in 1936 (Branson and Heinemann 1973:94); an AEU shop steward at Henry Hope's in Birmingham described the Bedaux system as 'the survival of the fittest in the crudest way; it was bloody cruel and it drove men and women mad' (Jim Crump, quoted in Leeson 1973:128); Barrett Brown (1934:28) reminded contemporaries that unmechanised work was physically harder but drew attention to increased demands on nervous energy and an increase in nervous tension.

<sup>4</sup> Baron et al (1988) found that bureaucratic personnel practices and scientific management techniques were less common in American industries with craft traditions like printing, publishing and leather.



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5        Fridenson says even the Marxist unions representing skilled workers rapidly accommodated themselves to Taylorism after the first world war (1978:169); 'with the assembly line, the advance over older systems is undeniable; production is greatly accelerated and the workers do not complain', wrote L'Humanite (Castele-Schweitzer 1986:71); the French socialist, Albert Thomas was an enthusiastic supporter of scientific management (Devinat 1927); Brady (1933) says German trade union leaders were friendlier to Fordism than Taylorism, but trade union leaders on the Board of the Institute for Labor Physiology believed the poison could be drawn from Taylorism through proper scientific study; the militant miners leaders, Robert Smillie declared scientific management to be a good thing, though he did not want it (or anything else) until the mines were nationalised (Brown 1977:197); G. D. H. Cole thought Cadbury been successful in 'adopting those elements in scientific management which tend to develop the worker's personality' (*Sociological Review* 1913); the socialists at the National Council for Labour Colleges defended time and motion study as simply the development of craft skills adapted to the machine age, a means of cutting out tiring work for the worker (*TSE* July 1951).

## **Postscript     The Rise and Fall of the Work Study Engineer**

### **Introduction**

By the end of the 1930s the influence of scientific management on production organisation and management was firmly established. In chapter 5 we saw that more rigorous time-study practice was spreading in the 1930s, in payment by results schemes in general, as well as in the form of the Bedaux system. But the most rapid growth in the use of time and motion study was undoubtedly in the years following the war, and particularly during the 1960s. However, the heyday of the industrial engineer was short lived. By the mid 1970s work study was being absorbed as part of a wider range of management services.

In this postscript I trace the post-war growth of work study and the history of institutes founded to represent work study practitioners, indicate the scale of work study applications across industry, and outline the transition from work study to management services.

### **The Growth of Work Study**

With the outbreak of war consultants were listed as a reserve occupation and Anne Shaw was seconded from Metropolitan Vickers to work with the Ministry of Aircraft Production. But the lessons most often drawn from 'the people's war' concerned personnel management rather than efficiency techniques like time and motion study (Brech 1945; Brown 1945). An OEEC conference in 1951 on the utilisation and dilution of skilled workers was dominated by UK accounts of its successful war time dilution programme (mss/200/B/3/2/C848). But there is evidence to suggest that 'arbitrary juggling with rates..... to avoid trouble when time and Supply Ministries pressed' tended to undermine time study standards



established before the war (MacIntyre 1957; *TSE* April 1948). War certainly encouraged the spread of work study but its post-war growth built on what had been established in the 1930s.

ICI led the way. By 1958 ICI was said to have 1,400 work study officers, 'four times as many as any other company in the world' (Dalziel 1956; *WSIE* Jan. 1958). In 1964 R. M. Currie put the number at 2,500 (1964a). Currie had been appointed at ICI in 1947 and quickly established a Central Work Study Section, which was made a department in its own right in 1953, after an investigation claimed to show that work study had made a net saving to the company of £2 million (Faraday, undated). Currie was an evangelist for work study, producing the only major, original British work on the subject (1964). And ICI carried the message to the rest of industry. In 1953 and 1954 conferences were held 'to place the company knowledge before the entire British chemical industry', and the exercise was repeated later in 1954 for the benefit of the British Institute of Management. At the request of Kipling from the Federation of British Industries, and Tewson of the TUC, Currie organised a series of open days in the Central Work Study Department which Faraday, appointed Assistant Manager of the Production Group in 1957, claimed attracted over 3,000 visitors. It was Currie who inspired the attempt to deploy work study in agriculture; ICI that supplied speakers for a conference on work study in hospitals for the Chartered Society of Physiotherapists (*WSIE* June 1958). And ICI managers like Faraday and McDavid who went on to take senior posts in companies like BOAC and British Oxygen.

The British Productivity Council, established in 1952 in the wake of the Anglo American Productivity Council, also spread the work study message, and in 1953 the National Union of Manufacturers set up a new work study unit to provide

advice for small firms (NUMAS). The BPC, together with the British Institute of Management and the Ministry of Education, also established the Work Study School at Cranfield in 1953. Cranfield offered a ten week course for senior work study officers as well as shorter courses in clerical work study (Organisation and Methods) and method study. 70 students enrolled in 1954 and 300 in 1958 (*WSIE* Jan. 1959). Work study education continued to spread<sup>1</sup>. By the second half of the 1950s, City and Guilds courses in work study were available at 'twenty five colleges, and eight firms and other organisations' (Sutton 1961). Even centres established for the study of human relations, like the Roffey Park Institute, ran courses on work simplification and production study, to address 'the techniques by which methods engineers and industrial psychologists can contribute to productivity through economy of effort, materials and time' (*TMS* April 1953).

Trade unions and Labour governments also encouraged the growth of work study (*TSE* Jan. 1951; *WSIE* March 1965). 'We could never have achieved what we did at ICI', wrote Currie, 'but for the increasing understanding and confidence of the British Trade Union Movement' (1964a). TUC co-operation with the post-war Labour government in the drive for production was an important element in its recommendation that 'unions should co-operate in the application of scientific management' (Carew 1987:150; Hutton 1953:49)<sup>2</sup>, but the roots of the TUC commitment went deeper. Germany had an enviable reputation for efficiency, but 'there is no parallel in Germany', wrote one industrial engineer, 'to the collaboration with trade unions which exists in this country' (Smith 1961). The trade union position was simple and pragmatic. 'We accept the principle of work study', wrote David Basnett of the General and Municipal Workers, 'but realise its limitations..... This means that we consider work study, or rather the data produced by work



study, to be negotiable' (1956). This insistence on bargaining undermined work study's claim to science but encouraged the wider deployment of its techniques.

### **Work Study Practitioners**

The term work study was not generally used even at the end of the 1940s and was not officially sanctioned until the British Standards Institute published its glossary in 1959. Anne Shaw was still complaining in 1950 that people mixed up time study with motion study, and 'to make confusion worse confounded, time study is now often called work study' (1950). Currie claimed that the close integration of time and motion study, and the international adoption of the term 'work study', was a predominantly British contribution to management science (1964:8). If it was, it was the result of a long battle to overcome divisions among work study practitioners, not only between time study and motion study, but between the motion study of Charles Myers of the NIIP and Gilbreth, and between time *and* motion study on the one hand and industrial engineering on the other.

All the main work study institutes were founded during the war. The Institute of Estimators, Planning and Time Study Engineers was established in 1941, changing their name a year later to the Institute of Economic Engineering and again, in 1953, to the Society of Industrial Engineers. They were followed in 1944 by the Motion Study Society, later renamed as the Work Study Society, and by the Institute of Industrial Technicians in 1945. Final amalgamation created the Institute of Work Study Practitioners in 1964 which, after much heart searching, became the Institute of Management Services in 1978 (*MS* Aug. 1978; Bryant 1969).

**Table 12 Work Study Organisations  
Origins and Development**

<b>Year</b>		<b>Organisation</b>	
1941	Institute of Estimators, Planning and Time Study Engineers		
1942	Institute of Economic Engineering		
1944		Motion Study Society	
1945			Institute of Industrial Technicians
1953	Society of Industrial Engineers		
1954		Work Study Society	

1958	Work Study Society (Society IE's and Works Study Society)	
1960	Institute of Work Study	Institute of Incorporated Work Study Technologists

1964	Institute of Work Study Practitioners (Institute of Work Study and Incorporated WS Technologists)
1975	Institute of Practitioners in Work Study, Organisation and Methods (following merger with O+M Society)
1978	Institute of Management Services

Source: Chronology of British Work Study Profession *Work Study and Management Services*; *Work Study and Management Services* Jan. 1975; *Management Services* Aug. 1978



Each founding organisation had its own specialist orientation. The Industrial Engineers were specialists in production planning and control and merged with the Production Control Research Group in 1946. The Society believed 'that the scope of work study practitioners should cover all activities involved in the planning and control of industrial production, and should not be limited to method study, motion study, and work measurement' (*TMS* March 1955).

The Industrial Technicians regarded themselves as time study specialists with a subordinate interest in motion study (*TMS* April 1955). Membership grew very slowly. In 1948 there were just over 60 members in London, and 83 in Birmingham, and while Birmingham membership grew to 152 in 1952, there were a mere 70 in Manchester in the same year. The IITech explained their slow progress as a result of the stringent standards the organisation set for entry and it was this issue which wrecked merger talks in the mid '50s. The Industrial Technicians railed with increasing bitterness about the epidemic of short courses allowing entry into the profession for the unqualified. Quality was now identified with Bedaux, 'We entered the field' wrote the editor in *Time and Motion Study*, 'with the Bedaux trained engineers, and with this flying start we have been able to attain the results of today, even though most firms have not insisted on Bedaux training and many have accepted staff under a system of training that can only be described as slipshod' (*TMS* May 1957). By 1960, some in the Institute were beginning to recognise that a policy of rigorous examinations was being pursued to 'a near suicidal degree' (*WSIE* May 1960).

The Motion Study Society was infinitely more flexible and adaptable. Founded to 'develop the technique of Motion Study as originated by Frank and Lilian Gilbreth' (*ME* April 1948) its magazine carried articles on work measurement by leading

American industrial engineers. Geoffrey Wade, who established the West of England Engineering Employers Association Work Study School in 1953, was a member of the AEI group which originally formed the motion study society. And Seymour Hills, who joined the Anne Shaw Organisation in 1951, was on the Board of the Cranfield Work Study School, becoming its Director in 1956 (Williams 1991a). Shaw herself showed only a grudging tolerance for time study and incentive schemes based on it, but the Motion Study Society attracted a wider group and changed its name to the Work Study Society in 1954 before fusion with the Industrial Engineers four years later. The society had a small membership to begin with - only 201 members in 1952 - but a number of companies affiliated, or had associate status, including GEC, Bibby and Sons, ICI, Dunlop, English Electric and Metal Box.

Merger talks in the early 50s broke down but in 1958 the Work Study Society and the Industrial Engineers agreed on amalgamation. Complete merger of all three branches of work study was accomplished in 1964. Membership was then growing rapidly. The Institute of Work Study claimed 4,000 members in 1963. The combined total of the newly formed body was estimated at 7,500, made up of 3,500 qualified practitioners and 4,000 students and graduates.

Not all those engaged in work study were 'engineers', whatever definition was put on that term. A membership audit in 1970 showed quite a spread, with one third classified as engineers and 20% as craft or skilled workers. About one third belonged to a trade union. In general, Institute members were 'less well represented at senior levels than at junior levels' (Minter 1970). Members of the Institute of Incorporated Technologists, with their fixation with professional standards, complained the loudest about the effect of short courses filling up the industry with



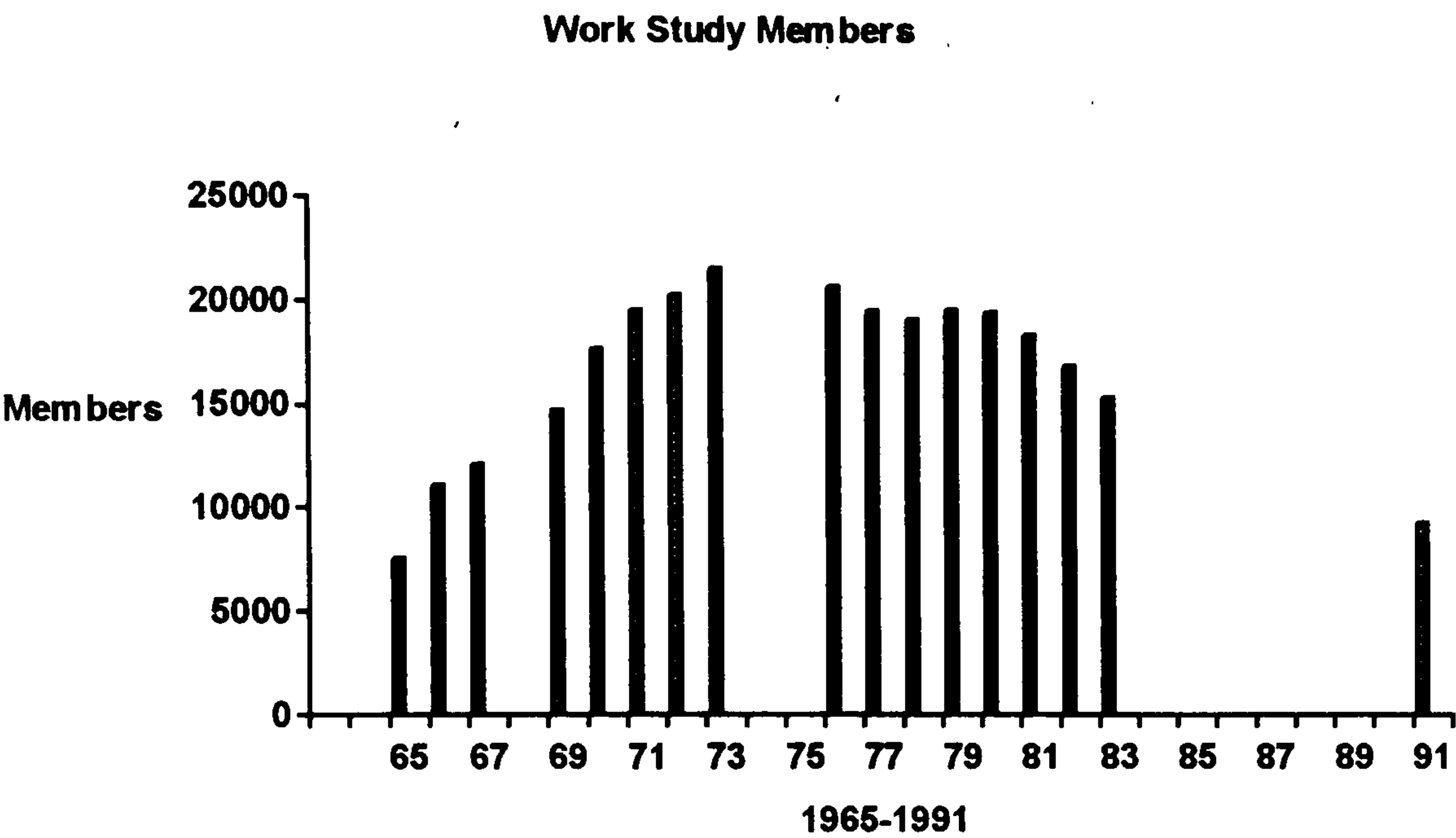
poorly trained men. 'Sausage-machine work study technicians' as one protester called them (*TMS* Feb. 1958). There were complaints that 'few employers seem to have heard of work study qualifications'. On the other hand, pay had improved with 12% of advertised posts offering pay between £1,000 and £1,300 (Randall 1962). This was considerably less than the £1,850 earned by managers in 1960, but a little more than foremen at £1,015 and considerable better than skilled manual workers at £796 (Routh 1965:104).

Work study in Germany and Sweden in the 1950s was more highly developed than in Britain. The German work study society had 15,000 members in 1957 (Carew 1987:221) and a survey by the German work study organisation (REFA) in 1958 found that between 85 and 90% of firms surveyed thought work study was either essential or very useful (*TMS* April 1958). No comparable survey of British experience exists but a smaller scale exercise conducted by the BPC's Aberdeen Productivity Committee in the North East of Scotland, reported in the same year, produced a stark contrast. Analysis of 152 replies found that '16% considered work study essential, 45% regarded it as useful, while 39% committed themselves to the view that it was not applicable' (Gordon 1958). Work study was also highly developed in Sweden where there was widespread interest in predetermined methods time measurement (MTM). A unified Swedish professional Association for Industrial Engineering was established in 1951 which deployed more than 3,000 practitioners in a third of Swedish engineering companies by 1965 (Korling 1963; *WSIE* April 1960; Svensson 1966).

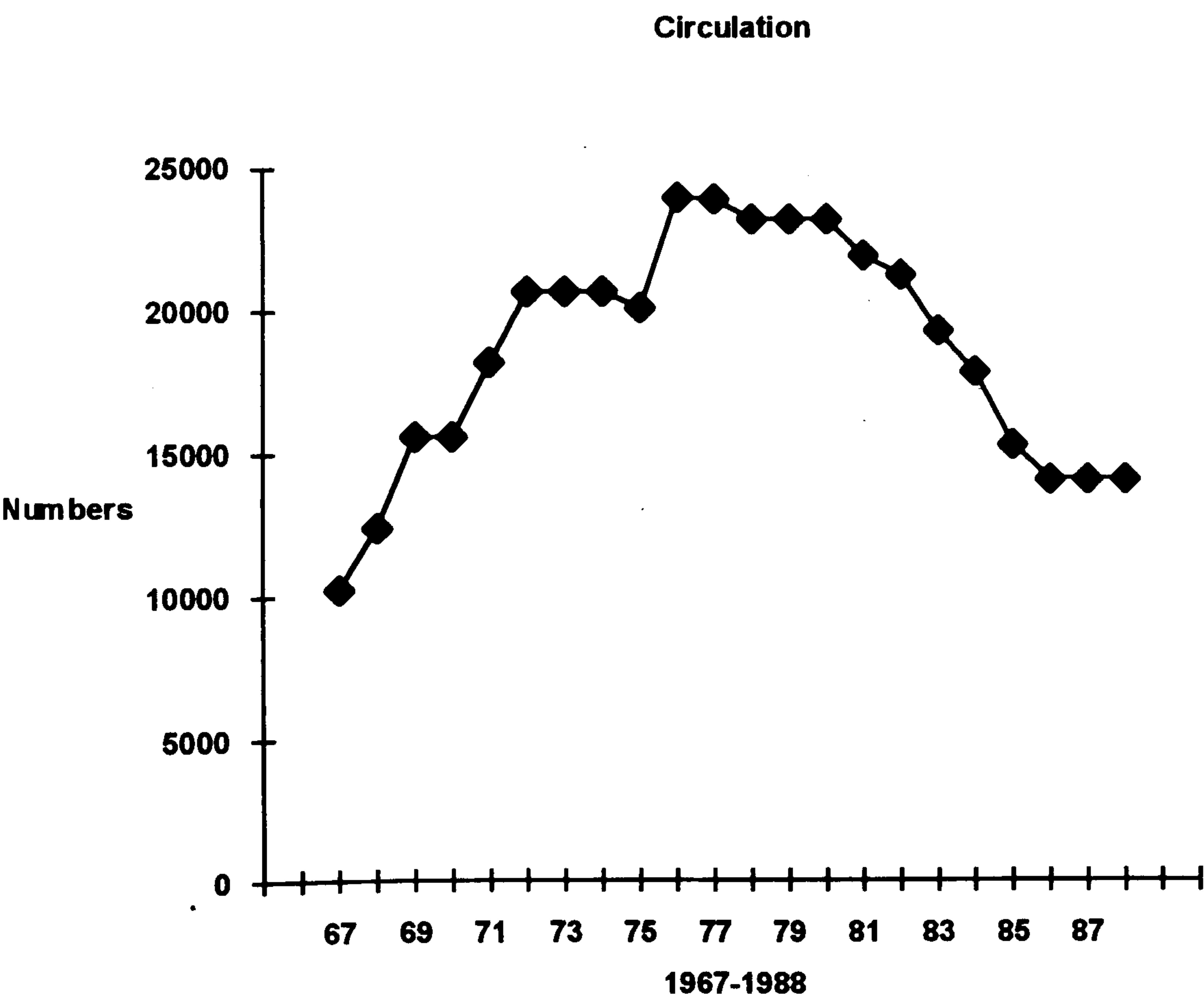
But by the late 1960s work study in Britain was catching up. Certainly the interest in work study, as measured by membership of professional institutes, had risen

dramatically. The charts below trace the growth in the membership of the work study institutes and the circulation of their journals.

**Figure 3      Membership of Work Study Organisations**



**Figure 4      Circulation of Work Study Journals**



Sources: Work Study Journals



By 1967 the Institute claimed to be 'the second largest professional institute of the subject in the world, yielding first place only by 2,500 members of the American Institute of Industrial Engineers' (*WSMS* March 1967). When the European Work Study Federation was founded in 1961 Russell Currie was elected its first President, and on his retirement in 1965, his successor at the Institute of Work Study Practitioners, J. E. Faraday took over as Secretary for the European organisation. Whether the Institute's claim to second place was accurate or not, expansion in the 1960s made the British more ambitious. They had helped to establish an Indian Institution of Work Study in 1963, and in 1968 Faraday established the World Confederation of Productivity Science with support from Australia, South Africa, Ireland and India.

### **Work Study Applications**

In many industries work study appears to have been introduced only after the second world war. Laundries and the boot and the shoe industry provide two examples. According to E. G. Phillips, who was appointed Production Engineer in 1949 and Production Superintendent in 1954 by the Institute of British Launderers, 'With one or two notable exceptions, work study was virtually untried in the laundry industry until 1946' (1955). Likewise, work study and incentive schemes had only made rapid progress in the dry cleaning industry since 1945 (Hulme 1953), and W. G. Howes told the Footwear Productivity Conference that, apart from some engineering plants which adopted time study around 1914, we in this country 'have only adopted these methods on any nation wide scale during the past twenty years' (1952).

Such reports are important and certainly evidence of a qualitatively new departure in the 1940s. But claims about the origins of 'work study' need to be placed in context<sup>3</sup>. We noted earlier (Chapter 1) that elements of scientific management were familiar in the boot and shoe industry in Bristol before the first world war and that conveyors were in use in laundries in the 1920s, separating workers and designed to ensure that women worked with the fewest possible movements 'and with no cross over of hands'. In 1934, fifteen years before Phillips took up his post as production engineer, the Laundry Employers Federation had appointed H. G. Maule as an industrial psychologist. He made studies of laundry operations and filmed a group of calendar feeders with the highest output, using the film to instruct other groups of workers in the best methods. He also found operators in the folding team who had to walk a couple of paces to reach the table on which to place the sheet and worked out that one of them walked twenty miles, and spent five hours, 'on this quite superfluous walking tour'. Of course, being a psychologist, he did not neglect to advise management to manage people with a smile, a friendly word and consideration (1948). Nevertheless, Phillips' work may not have been an entirely novel experience for the laundry workers who were studied by Maule.

In 1945 British Launderers established a production committee, and with the help of consultants, set up a Production Department with a staff of work study engineers to install an incentive scheme. According to Phillips, the scheme increased operator efficiency from 44 to 75 standard minutes per hour. In the footwear industry, two thirds of the male workforce was on piecework in 1967, 28% of them paid under the new time study agreement (NBPI Report 14). At Clarks the cost of implementing work study was less than 10% of the savings accrued from it, and time standards were used 'as the basis for an incentive scheme, for labour control, for planning and for costing' (*TMS* Sept. 1953).



The cotton industry had been an area where Bedaux had been particularly active before the war and one where work study, disguised as 'redeployment', spread more quickly after 1945. Between 1948 and 1950 the number of mills belonging to the Federation of Master Cotton Spinners which used work study increased from 84 to 119, or 24% of the total number of Association mills. By 1953 that number had grown to 184, or 38% of all mills. Nearly all the early applications had been carried out by consultants but the Cotton Board started its own work study school in 1949 and appointed a special officer who acted as secretary to the Federation's redeployment board (Jolly 1951, 1954). Time-study methods were further extended following a new wage agreement in 1956 (NBPI Report 34)<sup>4</sup>.

Work study was making significant inroads in the public sector too. Two hundred and nine local authorities (out of 1,800) were said to be showing a lively interest in the subject in 1959. Three years later a survey showed 540 authorities using work study or O+M (*TMS* May 1959, Dec. 1962). In 1956 British Railways appointed a director of work study, and in 1961 the industry claimed to have deployed 34,000 people on work studied jobs. Carriage cleaning, station staff, the parcels service and maintenance work were all affected (*WSIE* Jan. 1961; *WSM* April 1963; Walley 1963). In 1968 it was claimed that with more than 1,400 work study officers in the regions, productivity had increased between 1963-1966 by 20% (*WSMS* Jan. 1968). In 1953 the National Coal Board set up an advisory service on efficiency matters and Currie claimed the NCB trained 296 work study specialists in two years and completed 120 studies a month. Similarly, the British Transport Commission established its own work study centre and work study schools (Currie 1958). The army opened its new work study school in Wiltshire in 1963 to service the army work study group which employed about four hundred officers and

civilians (*WSM* July 1963). And the RAF appointed its first director of work study in 1955, centralising operations in 1965 in a unit about seventy strong (*WSMS* Nov. 1969). In the hospitals it was estimated that around 160 staff were employed on work study in 1963(*WSM* Aug. 1963).

Work study was not confined to industrial processes, public or private. Harrods, Sainsbury, John Lewis, W. H. Smiths and Marks and Spencers all operated work study. Marks and Spencers was among the most interesting. Recruitment was frozen and the number of staff allowed to fall by 20% and new, simplified systems employed in the stores, purchasing and personnel. But in a move unusual for work study, the head of personnel, M. J. Glen, argued that everyone had to be involved to ensure that systems were necessary as well as efficient. To that end, the stock room was thrown open to all, time clocks were abolished as were all staff grades other than management and supervisor. In a distinctly modern phrase Glen explained that the guiding principle was that people could be trusted, 'Once this is recognised a whole host of accountancy checks and cross-checks can be thrown overboard' (1959). At Sainsbury, work study began in the '30s in the warehouse and factory operations . But after the war it was more widely used, being the responsibility of a senior executive reporting to the Board (Turner 1963).

Courtaulds had employed consultants in 1937 but as Coleman remarked, scientific management was anathema to the old school (1969:455). Not so for their post-war successors. In 1953 the company was designing a special truck so that the operative's work cycle could be carried out with a minimum of movement, advertising a vacant traineeship at its 'Coventry Work Study Headquarters', and offering advice on the industrial relations problems of introducing time studied systems (*TMS* March 1952; Cummings 1952; Gibbons 1954).



Further examples might be cited from a number of industries including pharmaceuticals, printing, steel and engineering, but perhaps enough has been said to establish the point that work study, though far from being in use in every industry or workplace, was growing rapidly in all sectors of the economy. Its use was not confined to incentive schemes. In a survey carried out in 1965, A. L. Minter, later head of work study at Longbridge, found the most commonly reported uses of work study as follows

**Table 13                      Work Study Practice 1965-66**

<b>Uses of Work Study</b>	<b>% of replies</b>
Incentives	77
Planning	61
Labour Control	70
Costs	77

Minter (1966)

In the same year, the Institute of Works Management reported a survey 'designed to find out what proportion of the working force is paid on incentives, what sort of incentive, and how the work is measured' (1966). Although the survey produced only 229 returns, the Institute claimed them to be reasonably representative of industry as a whole. Of the replies, 83% had some sort of incentive scheme and two thirds used some form of work measurement. 'Of the type of work measurement used, Time Study (65%) was the most popular, followed by Synthesis (40%). The surprising fact was how few firms used the post-war techniques of Rated Activity Sampling (14%) and PMTS (5%)'. A breakdown of

the use of work measurement by 68% of the firms reporting showed that while the largest single element set work measured targets, most used a mixture of methods.

**Table 14 IWM Survey 1966**

<b>Method</b>	<b>Number of firms</b>	<b>Percentage</b>
Rate Fixing	18	9
Targets/Work Measurement	63	33
Lieu Bonus	6	3
Rate fixing and Targets	8	4
Rate fixing and Lieu Bonus	26	14
Targets and Lieu Bonus	39	21
Rate fixing / Targets / Lieu Bonus	19	10
None	8	4
Spoilt	3	2

A more comprehensive survey, based on figures from the *New Earnings Survey* for 1979, showed a smaller, but still substantial proportion of firms using work study in connection with payment by results schemes. 41% of manufacturing plants, covering 27% of all male manual production workers, based their schemes on work measurement (White 1981:70). But the use of work study was more widespread with 64% of plants making some use of work measurement.

Although generalisations are dangerous because of the extreme unevenness of the experience, it would probably not be too far out to say, that so far as industrial engineering techniques are concerned, Britain had at last reached the point that America passed in the early 1930s.



## **Work Study and Management Services**

Even as work study applications multiplied, the ground was shifting beneath the work study engineer's feet as new management techniques came on stream and attention began to be focused on wider problems of organisation and management<sup>5</sup>. In the process, the distinctive identity of work study, so recently established, was surrendered for a place within management services.

In some respects, the work study profession demonstrated great flexibility, particularly in its attempt to absorb the impact of new concerns with human relations and demands for the re-design of jobs in the early 1970s. But the growth of work study also served to illustrate the limitations of its core techniques for use with payment by results and encouraged demands for a more sophisticated approach. In its evidence to the National Board for Prices and Incomes, Urwick Orr criticised British employers for operating with a preconceived idea of what their problem was, and a preconceived solution to it, which 'stemmed in part from the acceptance of the classical theory of scientific management and, in part, from current management ideology' (Urwick Orr 1968:7).

the pre-determined problem has been how to measure what is a fair day's work; and how to motivate the worker by means of a financial payment to achieve this standard. The preconceived answer was felt to lie in more accurate work measurement with directly related financial incentives. The concept of examining the viability of payment by results schemes in a particular technology and in terms of managerial capacity and existing patterns of industrial relations, was quite unacceptable to many managements (1968:7).

For the firm created by one of the British pioneers of scientific management (Urwick) and one of Bedaux's lieutenants (Orr) to criticise British management for being trapped by classical scientific management theory is rich with irony. It seemed that British managers had no sooner acquired a scientific foundation than they were told to move on.

It was not just Urwick Orr, however. The work study profession itself was increasingly aware of its own need to change. Automation was an early cause for concern. In 1955 it was noted that 'automatic computing machines are wiping out office personnel far more efficiently than ever work study could hope to attain' (*TMS* June 1955). More generally, the argument was more frequently heard that increased mechanisation and machine paced work narrowed the scope for traditional time study which reinforced the long-standing ambitions of work study for a wider role. In America it was said that new developments in operational research, data processing and automation were encouraging a new breed of industrial engineer emerging as a top level research and development person concerned with the design of new systems for management and production (Leherer 1959). In Europe too it was suggested that the focus of work study was shifting from method study as a corrective device to pre-production planning (De Jong 1958). At the same time, many of the functions carried out by work study people were also carried on in production study and operations research departments, advisory and planning departments (*WSIE* Jan. 1959). And many new techniques were being developed which threatened to overshadow work study claims to be the key to efficient production. At the United Steel Co. Ltd, Stafford Beer, head of the Department of Operational Research and Cybernetics, regarded work study as suitable only for relatively simple systems (1958).



The combination of the spread of work study, some challenge to its traditional core in work measurement, and the development of new techniques aimed at achieving the same results, created pressures for change. In 1965 the Swedish Work Study Institute reorganised to create separate departments for work study and production engineering, and work study and wage systems (*WSM* Dec. 1965). In 1966 the European Work Study Federation noted with approval that various management techniques, including work study, had been brought together at British Rail under the heading Productivity Services. When McDavid was appointed at British Oxygen in 1966 it was as head of Productivity Services. At BOAC Faraday's job title changed in 1967 from Chief of Method Services to Chief of Productivity Services. And, in a further sign of the times, the Wool (and Allied) Textile Employers Council changed the name of its work study centre in 1967 to the Management Services Centre (*WSMS* March 1967). The future for work study lay with the wider management task rather than a specialist service for the design of incentive schemes.

Discussion among work study practitioners began in earnest in the mid '60s. Work study should be placed in the context of all the 'operational sciences', argued C. T. Gould, including operational research, cybernetics, ergonomics and market research (1966). In similar vein S. Robinson nominated work study, value engineering, cost control and O+M as the core of co-ordinated management productivity services (1966). At the end of 1966 the IWSP issued a plan for the next five years with the clear purpose of steering the organisation away from an exclusive focus on work study. It was not just a question of the growth of new management services. The plan argued that 'To restrict the Institute rigorously to those techniques that are agreed to belong exclusively to work study and nothing

else would not fulfil the aspirations of the more senior membership who would seek another focal point for their professional leanings' (*WSM* Dec. 1966). And, since productivity was the theme of the 60s, it was proposed to rename the organisation The Institute of Productivity and Management Services.

The proposed title reflected the particular advocacy by Faraday of the concept of 'productivity' as the essential link between a number of management tools from systems analysis to ergonomics (Faraday 1967a; 1967b). In 1968 the Institute established a technical board to set up technical divisions covering Method Study, Work Measurement, Social Human and Motivation, O+M, Ergonomics, Operational Research, Network Analysis, Value Analysis and Systems Analysis. Similar changes had been carried out by the American Society of Industrial Engineers. The IWSP's reorganisation was welcomed by some members as part of the work study engineers' 'productivity mission' (Freeman 1969). But it was denounced by others. Victor Smith argued that 'this is the age of specialisation and if we try to do everything we end up by doing nothing. Unfortunately the signs are increasing that this is precisely what is now happening in the work study field' (1970). And P. E. Randall expressed the bitterness of some members that 'The status-seeking Productivity Services people, not content with a profession that had been good enough for Frank Gilbreth, Anne Shaw and Russell Currie, sought to combine work study with a hotch potch of unrelated subjects' (*WSMS* Dec. 1970).

But Currie had himself warned more than ten years earlier that 'there are still far too many within our ranks whose minds are pitifully tied to the stop watch', something he described as a 'hand loom attitude' (1958). At ICI work study had long been developed in depth to deal with improved deployment of manpower, labour costing, planning and the maintenance of production. In an amusing



comment on an early ICI application of method study, J. B. Kitchen observed that the company made the error of applying method study to the individual operator at his workplace, 'We ended with a number of men efficiently carrying out tasks which in certain instances the company did not really want performed at all' (Ireson and Kitchen 1960:14).

The Institute's leading lights wanted to 'raise the profession from its present technique orientation to a functional orientation'. But equally they wished to retain the core claim of scientific management, 'The systematic approach of the disciplines in Productivity Science distinguishes them from others which may achieve the same objective by experience, intuition, ingenuity, trial and error, or other means' (WSMS Jan. 1971). Faraday had resisted adopting the more general title, Management Services, because it was not sufficiently specific. He wanted Productivity Science as the concept and Productivity Services as the name for the relevant functions within an organisation (1967). But the IWSP journal was renamed *Work Study and Management Services* in 1967 and simply *Management Services* in 1975. The new journal, declared the editor, 'will of course continue to serve the various interests of our diverse membership, but at the same time will reflect the move to group disciplines like work study and O+M under the collective name of Management Services' (MS Jan. 1976).

By 1978, when the organisation finally changed its name to the Institute of Management Services, it was argued that the new title was now appropriate, 'With only just over a third of members with work study and organisation and methods in their job titles it is clear that the traditional terms are no longer adequate' (MS Aug. 1978). Work study had been absorbed into the productivity sciences, and productivity sciences into management services.

## Conclusion

This sketch of the post-war history of work study is obviously incomplete. There is no space to consider, for example, the limitations of work study science as theory and practice, the failure to insulate work study from bargaining in schemes of payment by results, nor to explore the development of post-war management more generally. Nevertheless, a number of provisional conclusions are suggested.

In the first place it is clear that British industry *did* adopt Taylorist work study. By the late 1960s its influence was apparent in the public and private sector, in manufacturing, and in retail. The argument that work study was only applicable to standardised mass production industry was still occasionally heard but carried less weight. At a clothing manufacturer investigated by the NBPI, Steinberg Ltd, work study was 'central to the operation of the wage system' but production schedules could hardly have been less standardised. Managers studied sketches arriving in the morning mail, together with the prices at which items were to be produced, before 'breaking this down into component parts for the production lines' (NBPI Report 26). Rowan Thompson had declared that Taylor's time study was magnificent but it was not business. In the 1960s it seemed that work study was in business everywhere.

However, it *is* remarkable that this form of Taylorist practice took so long to develop on a generalised scale. Britain was almost certainly thirty years or more behind America in this respect. But British practice was not much out of step (if it was out of step at all) with developments in Europe. If the decline of the British economy relative to Europe during the post-war boom owes something to the backwardness of British management, neither backwardness or decline can be



attributed to a failure to adopt the techniques of time and motion study advocated so many years earlier by Taylor.

The post-war rise and fall of the industrial engineer also suggests two rather paradoxical conclusions. First, although work study spread rapidly after the war, it is clear that the industrial engineers of the new institutes built on the foundations laid by production engineering, time and motion study, and the Bedaux system between the wars. It appears that conditions of full employment and increased trade union bargaining power proved more conducive to the success of Taylorism than a weaker trade union movement and conditions of hardship associated with unemployment and slump.

Secondly, the eclipse of the new work study profession was as spectacular as its rise. By the mid 80s, membership of the Institute of Management Services had fallen back to roughly what it had been in the mid 60s. It is almost as if the triumph of work study proved its undoing. In part at least, this has to do with the post-war history of payment by results. But it also has to do with the changing character of management and scientific management. Taylor had been dead a long time. His system of time and motion study was denounced by a trade union official as belonging to the horse and buggy era (*WSMS* May 1969). Even Russell Currie warned against a 'handloom attitude' to the use of the stop watch. Time and motion study began as part of a broader programme for the management of production. Work study as a set of discrete techniques was ultimately absorbed into a more modern form of production organisation and management.

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## Notes

<sup>1</sup> The *Times Review of Industry* (Nov. 1954) reported that 600 full and part time trade union officials had attended a one week course in production and production management in a period of three and a half years, and that the TUC had made arrangements with AIC (the old Bedaux company) among others, to provide further training in work study techniques for full time officers.

<sup>2</sup> Hutton quotes the TUC Report *Trade Unions and Productivity* (1950), 'Unions should seek to co-operate in the application of 'scientific management' which, even if not an exact science, can make a valuable contribution to increasing productivity in industry' (Hutton 1953:49).

<sup>3</sup> Reviewing *The Making of Scientific Management* in 1945, J. A. Bowie described scientific management as 'a movement old enough to be interested in its parents'

<sup>4</sup> The Final Report of the Anglo American Council on Productivity noted the increase in work study in cotton spinning and doubling since the team's visits from 84 mills in 1948 to 141 in 1951, amounting to 27% of the 525 mills in Lancashire.

<sup>5</sup> Among the more interesting of these developments was the concerns with quality management. The American trade union expert, Solomon Barkin, declared that 'the time study men must give way to the statistical control techniques of the quality control men ... Unlike the time study man, he is alert to the dynamic character of operating conditions. His tools are designed to measure variations and to police a defined permissible range of variations in conditions' (*TMS* Jan. 1956). Horn (1979) discusses the post-war development of the behavioural



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sciences and the growth of a new range of quantitative techniques. Williams (1991) related the decline of work study to the growth of alternative techniques and the fall in the incidence of labour intensive work.

## **Conclusion**

### **Introduction**

The main arguments of this study were summarised in the introduction together with a brief discussion of its principal themes. They include the relationships between technology, business and management as these emerged from the scientific-technical revolution at the beginning of the 20th century; the historical meaning of Taylorism and its slow progress in Britain in the context of the uneven development of the British and world economy; the effects of Taylorism on the division of labour on the shop floor and in the office; the effects of worker resistance and the role of the unions in accommodating Taylorism through the mechanism of struggle and collective bargaining; and the inability of Taylorism, as ideology or practice, to overcome the fundamental antagonism of an employment relationship founded on exploitation.

In this conclusion I shall try to state briefly what I consider to be the main contribution this study makes to our knowledge of Taylorism and the development of management methods in Britain. But rather than repeat the general argument, or elaborate on conclusions already stated, I shall also attempt to look forward as well as back; to ask whether Taylorism has been superseded by changes in the labour process and to relate that question to the wider debate about 'post-Fordism' and flexible specialisation. No attempt will be made to deal with these issues in a comprehensive way, only to indicate the direction of change and suggest ways in which this study may be of relevance to contemporary concerns. It is argued that changes in technology, business and management in the 1990s have the potential to bring about far reaching changes in the way in which the labour process is



conducted but that some of the key players in 'post-Fordist' industry build on Taylorism rather than reject it.

### **Scientific Management in Britain**

No very great claims will be advanced for this study. It does not propose a new theory of the labour process and its account of Taylorism in Britain, while distinctive in some respects, finds common ground with others in acknowledging the slow development of time and motion study and continuing weaknesses in the area of production control. However, more modest but worthwhile claims can be made in a number of areas.

First, it has been possible to make sense of Taylorism, and reconcile divergent accounts in management, historical and labour process literature, by re-uniting scientific management with its historical context. It would be difficult to imagine Taylorism without the technical and business changes which produced it, and which Taylorism helped to define and develop. Yet in much of the literature analysis begins with a largely ahistorical 'concept' of Taylorism (and/or 'Fordism') which reduces scientific management to a set of highly specific nostrums or even a time-studied incentive scheme of a particular kind. From this point it is easy to conclude that Taylorism had little influence in Britain. The trouble with such a conclusion is that it makes it all the more difficult to understand much else. In particular, the development of similar management structures, production engineering and division of labour, in industries and workshops which acknowledged Taylor as master and those that did not. Ford thought he was not a scientific manager; Taylor was quite sure he was. There is a sense in which they were both right. Ford's achievement is not reducible to Taylorist principles but it

was consistent with them; Ford did not use incentive schemes, much less the differential rate, but he practised in his own way what Taylor preached.

There is a danger, of course, that in locating scientific management historically, the specific character of Taylorism is lost in the development of 20th century management in general. This danger must be avoided but not at the expense of severing the connections between historical phenomena and misunderstanding the relationship between them. We need to distinguish premium bonus from Taylor's more rigorous scheme but should see them both as variants of the same shift towards 'task work'. We properly distinguish the Bedaux system from piecework as it operated at Rowntree's Cocoa plant but we ought to take Northcott's point that the Bedaux system was not fundamentally different from modern practice elsewhere. The specific prescriptions of the efficiency engineers, whether out of the Bedaux stable at Lucas or from the efficiency department at Longbridge, differed from the less systematic practice of production engineers and planning departments elsewhere, but all were engaged in a similar process.

A second, and related, point concerns the reception for scientific management in Britain. Historians have tended to repeat, uncritically, the judgement of Urwick and Brech that engineers and employers were either hostile to Taylorism before 1914 or ignored it altogether. In fact, there was considerable discussion of Taylor's ideas even before the Eastern Rate case brought new publicity and notoriety. Perhaps more significant was the identification of Taylorism as an extension of specialisation and as a programme for the organisation of production which enabled the engineering press to make connections with British experience.



That experience was certainly mixed as a modern, mass production economy emerged only slowly and unevenly in Britain in the 20th century. British economic supremacy had been based on a relatively primitive industrial technology. The decline of the British economy relative to its competitors was rooted in a 'slowness of adaptation' to changing conditions, something Phelps Brown has described as the 'British predicament' (1977). Failure to adapt quickly enough has sometimes been attributed to structural constraints, sometimes to the peculiar character of British class and industrial relations. This study has found evidence of British capitalist conservatism which limited the pace of change and, perhaps, the degree of thoroughness with which new methods were adopted. Even scientific managers like Mavor shrank from a complete endorsement of Ford's methods while industrial 'blimps' like Viscount Inchape denounced the mass production of ships as 'the communism of ship construction' (Hannah 1976:148). Such conservatism was rooted in the early industrial experience rather than the survival of aristocratic values, and in the economic 'common sense' of employers who continued to make money using existing plant and old tools. Such conservatism was sustained more by an anti-theoretical empiricism and pragmatism (which so irritated the likes of Urwick), than by the pressure from craft workers<sup>1</sup>. Indeed, the empiricism and pragmatism of employers was matched by workers, craft and non-craft, and by their trade unions which were unshakably committed to the idea that everything was negotiable. If anything, trade unions, though not always their members, showed themselves to be more adaptable to changing industrial conditions than their employers.

The difficulty lies, not in identifying employer conservatism, but in assessing its effects and the danger of exaggerating its influence. The development of the British economy, and of its industrial structure and management methods, was uneven but

it did develop. Conservatism did not prevent British employers from adopting Taylorism in their own good time, and in their own way, and certainly did not mean they opted for a human relations oriented alternative as Merkle (1980), for example, seems to believe. The post-Braverman consensus in the labour process debate came quite close to saying that scientific management had little impact in Britain because employers did not want it *and* because worker resistance would not let them have it. Neither proposition, together or separately, is correct.

On the question of deskilling and managerial strategies, for example, it is clear that the direct application of specifically Taylorist schemes played a relatively minor role before the late 1930s. But it is equally clear that a deskilling dynamic was at work with the spread of mechanisation and the Taylorist forms of management associated with it. The 'subtleties of production' were reallocated to new management functions in planning and progress departments and time study increasingly underpinned systems of payment by results. These methods were more evident in the newer industries but even in more traditional engineering employers made conscious attempts to deskill the job, the turner and fitter were overtaken by the new 'machine trades', and the craftsman and foreman increasingly relocated on the periphery of production processes.

What this study also suggests is that more attention should be paid to the effect of scientific management on women and on semi and unskilled men. The reorganisation of work and the imposition of detailed work standards and effort norms ensured that workers, who might have experienced semi-skilled work as an upgrading from labouring, often found themselves in the forefront of battles against efficiency engineers and speed-up. The degradation of labour in the service of capital was not confined to skilled men.



As long as we are careful not to share Taylor's illusion of the finality of management 'science' (something Braverman is unjustly accused of), it is clear that worker struggles could not prevent the reconstruction of the labour process along scientific management lines. Nor is there any real foundation for the view that workers' struggles, including resistance to scientific management, delayed or prevented the modernisation of British industry in ways which could account significantly for economic decline<sup>2</sup>. This not only neglects the unequal distribution of power between the two sides of industry, but also fails to notice the way in which the labour movement so readily absorbed change as long as change was negotiable. This is most obviously true at the level of the trade union as an institution, but even on the shop floor British engineering workers fought for money and jobs, not the retention of a 'craft mode of production'. Politically and ideologically the labour movement was quickly persuaded to incorporate Taylorism into its own version of progress. Shop floor resistance, real and effective though it was within limits, was therefore conducted under a double handicap.

One of the more curious ideas thrown up by the labour process debate is the belief that piecework was an employer labour strategy which surrendered control to the shop floor. Lewchuk goes so far as to argue that 'Piecework systems, as adopted in British engineering, resulted in a sharing of managerial authority and a crude form of industrial democracy, since labour was allowed control over the pace of work' (1984:358). So widespread has this idea become that even so renowned a historian as Hobsbawm (1984) repeats it.

In fact, there is little, if any, evidence to support the idea. Firstly, the proposition usually depends on the misconception that Fordism constituted a separate mode of

labour control based on machine pacing. Secondly, premium bonus and time-studied incentive schemes (to say nothing of Bedaux) were actually progressively more systematic employer attempts to secure tighter shop floor control over the pace of work, and this is clear both from the testimony of those who designed and implemented such schemes and of those who worked under them. It is true, of course, that control did not always follow from the attempt to secure it. What many British engineers and employers understood, as Taylor had so often insisted, was that no incentive scheme was worth a candle unless backed by sophisticated methods of production control - not so-called Fordist machine-paced labour strategies - but detailed production engineering and planning. Deficiencies in this area were more likely to undermine incentive schemes than the reverse. Nor is the fact that piecework schemes could 'degenerate' evidence that they involved a surrender of control in the first place<sup>3</sup>. Even schemes based on Bedaux's version of scientific management proved to be vulnerable to 'decay', that is to say, the effects of their own internal contradictions and the effects of class struggle.

Even in the 1960s, when it was believed that shop floor controls over incentive schemes were particularly strong, most shop stewards welcomed opportunities to get rid of them (Brown 1973). There would have been fewer still to speak up for piecework between the wars. And this has to be odd, if piecework really did give labour a crude form of industrial democracy and control over the pace of work.

The last thing employers in engineering or the motor industry were interested in was a sharing of managerial authority. The right to manage was the EEF's *raison d'être* for more than fifty years. It was a principle which could be defended with great tactical sophistication as it was in the early battles with the engineering unions, and was consistent with a limited recognition of the skilled worker's



property right in his own skill so long as its exercise was at the employer's discretion. But in principle the right of each individual employer to manage was absolute. Ironically, its character as fundamental doctrine served, in the end, to undermine its purpose. Between the wars the right to manage justified an increasingly inflexible refusal on the part of engineering employers to negotiate labour grading arrangements with the unions. Employer power, relatively free of constraint, was used to impose judgements about pay and machine staffing in ways which created almost continuous argument and debate at shop floor level about new machines, new jobs and new processes. When the balance of forces in industry shifted towards labour, shop floor organisation, encouraged by the obdurate insistence of employers on their *individual* right to manage, asserted itself.

This brings us to a final point in this summary conclusion. This study tends to confirm the main thrust of Braverman's argument in a number of respects. Taylorism *did* come to constitute the 'bedrock of all work design' (1974:87) in Britain; the management of mechanisation in the 20th century *did* reinforce a capitalist deskilling dynamic and the labour process *was*, in this way, reconstituted more directly under management control. But that 'control' was not something finally established once and for all. Formal subordination of labour establishes new conditions for old struggles, not *the* victory of capital over labour. The concessions labour extracted for its accommodation to the new regime were real and significant, sufficient to soften the *experience* of scientific management and sustain a reformist politics in the wider social arena. Braverman's narrower focus on changes in the labour process therefore has its limitations. But a more complete understanding of the social organisation of production will build on its strengths.

I turn now to consider whether the labour process in the late 20th century is going beyond Taylor, and if it is, the extent to which any significant shift in the labour process is likely to build on or abandon scientific management.

### **The Post-Fordist Argument**

Flexibility became one of the buzz words of the 1980s. Functional or task flexibility was defined as 'the ability of firms to reorganise competencies associated with jobs so that the job holder can deploy such competencies across a broader range of tasks' (NEDO 1986). The flexible firm would combine functional flexibility with other forms of flexible organisation from an increased use of sub-contracting, the creation of a peripheral workforce of part-time and temporary employees to match its core workforce, an increased use of shift work and performance-related pay. Such employment practices are not new. But the argument is that flexibility has a new significance as the harbinger of a newly emerging form of production. The economy of the post-war world is being transformed. The large scale mass production industries with their standardised products (Fordism) are giving way to smaller scale, more specialised and more flexible forms of production. Computer controlled processes are the key, making more detailed control over production possible and providing the re-programmable equipment necessary to redesign products for more rapidly changing consumer tastes. The crisis of Fordism arises from the saturation of markets with mass produced goods and the opportunities for specialised production for niche markets which new technology makes possible (Murray 1985).

Labour relations are reconstructed too. Unions are marginalised if not derecognised (Beardwell 1992) because the new, more flexible forms of human



resource management are incompatible with a pluralist industrial relations (Guest 1989).

In most accounts Japan provides the model from which to learn if not imitate. But according to Piore and Sabel flexible specialisation offers even more, nothing less than the chance to recreate a lost world of craftsmanship. Policy makers can choose one of two strategies. 'The first strategy builds on the dominant principles of mass-production technology.....The second strategy veers sharply away from established technological principles and leads back to those craft methods of production that lost out at the first industrial divide' (1984:10). In some versions change on such a scale reaches beyond the worker, the firm and the economy, so that post-Fordism links arms with post-modernism; 'the mass consumer, the big city, the big brother state, the sprawling housing estate and the nation state are in decline: flexibility, diversity, differentiation, mobility, communication, decentralisation, and internationalisation are in the ascendant' (Jacques, quoted in Costello et al 1989; Harvey 1989).

Critics have challenged the various accounts of the coming of post-Fordism on a number of grounds. Pollert has argued that continuity is more apparent than change in the flexible uses to which labour is actually put. Talk of the flexible firm 'conflates and obscures complex and contradictory processes within the organisation of work, and by asserting a sea change of management strategy and employment structure, fuses description, prediction and prescription towards a self fulfilling prophecy' (1988:42). Costello et al point out that mass production has conquered the high street in the form of MacDonalds and (often Japanese) electronic goods, and suggest that 'The Post-Fordists have, in their enthusiasm, plainly over egged the pudding ... they have picked on some real trends and

generalised them out of all recognition' (1989:30). And Fergus Murray has argued that for many workers of the 'Third Italy' flexible specialisation has led to 'the worst excess of industrial capitalism' not a new craft workers utopia (1987:92). In a wide ranging review, Hyman criticises the theoretical claims of number of post- Fordist theories. Such theory is understandable against the background of the historical disjuncture of the end of the post-war boom but represents nothing more than the continuation of inherent capitalist instability, the "'uninterrupted disturbance of all social conditions": a more elegant equivalent of the notion of flexibilisation' (1991:282).

### **Labour Process, Management and Unions**

At Vauxhall, during the 1989 wage negotiations, the unions were presented with a document setting out the company's aims for team working and related changes in working practices. Entitled *Meet the Challenge*, it proposed to phase out time-study methods of controlling work allocation in favour of the principle of continuous improvement. A joint study by the Centre for Alternative Industrial and Technological Systems and the Merseyside Trade Union Community and Unemployed Resource Centre found that the unions were successful in preventing this,

.. in the agreed version of the document, the unions were successful in retaining time-study measurements as a means of determining work targets employees are capable of. Without this system, the unions feared they would be impotent if the company tried to increase work allocations beyond reasonable limits (1991:26).



The CAITS/MTUCRC pamphlet was entitled *New Union Strategies* but this was a very old union strategy indeed, and invites parallels with the history of piecework. The image of employers trying to dispense with Taylorism with workers defending it is such a strong one, it suggests something more fundamental may be at work.

One explanation is that new technology and associated changes in production organisation have put a premium on worker co-operation and commitment, if not re-skilling, which makes the old ways of directing labour with detailed instructions for carrying out fragmented tasks no longer appropriate. The argument is that 'Sophisticated, flexible, expensive equipment needs sophisticated, flexible, expensive people to operate it. The effective and safe operation of these new technologies requires very careful attention to work design' (Buchanan, quoted in McLoughlin and Clark 1988:181). New technology is employed most effectively where it complements rather than replaces human skills, argue McLoughlin and Clark, and managers who continued to act to reduce the human element 'undermined the effectiveness of the use being made of the new systems and equipment' (1988:168).

But the fact that any technology has the *potential* to be used in ways which enhance the skills of labour is no guarantee that it will be used in that way (Armstrong 1988: 148). Elger's review of technological change and work reorganisation in the 1980s suggests 'a recurrent juggling of competing priorities, involving the control of labour costs and worker effort, alongside some mobilisation of worker consent or initiative, and, through these, attempts to exploit fresh technical possibilities for product development and cost reduction' (1990:68). To some extent it is a matter of how change is perceived. Berggren recounts the opinion of one Saab consultant who thought Honda's operation was 'a total new

work experience, egalitarian, dynamic, uniquely productive'. The same experience was described by other Saab managers as 'a frantic workplace, relentless attendance demands, unsafe production equipment, and heavy indoctrination in a quasi-totalitarian culture' (1993:164).

A highly critical account of Japanese production techniques by Delbridge et al also suggests that increased responsibility and accountability of workers in a just-in-time, total quality management environment, means 'a reversal of the trend towards a separation of mental and manual tasks documented by the de-skilling labour process theorists...' (1992:100). However, the same workers are said to be more completely subordinate to capital than ever because such regimes 'demand and create a situation where management prerogative prevails and where there is little, if any, room for employees to exercise counter controls over the pace of work and task execution' (1992:98). Mutiskilling turns out to be multitasking where every worker is interchangeable and none irreplaceable. At Toyota a worker allocated too much time was obliged to stand still and do nothing as a demonstration to others that too much time had been allowed<sup>4</sup>.

In such circumstances the production planning that lies behind just-in-time systems retains its monopoly on mental labour whatever new demands are placed on employees. Klein observes that the elimination of buffer stocks reduces the opportunity for discretion in task execution and suggests that work group autonomy is re-directed towards task design (1991). But the worker participates as subordinate, not craftsman or political master, and it has to be doubtful whether such participation provides any meaningful mental labour or increased control. As we noted in the postscript, Taylorism in the form of time and motion study coupled to incentive schemes belonged to the horse and buggy era. The more sophisticated



production engineering of just-in-time systems are a more advanced application of Taylor's principles, not abandonment of them. According to Schonberger, 'the Japanese out-Taylor us all - including putting Taylor to good use in QC (Quality Control) Circles and or small-group improvement activities' (quoted in Dohse et al 1985:127).

If we turn our attention from the management of work to the management of people, there is further evidence of a significant shift in thinking which carries management away from the organisational formulas and structures of Taylorism but evidence too, of the same difficulty in really overcoming the past.

The convictions of classical management theory began to crumble from the 1960s and all but disappeared by the 1990s. Contingency theory seemed to offer a sufficiently flexible formula for a while but in the 1980s it was argued that, 'General theories are no longer adequate (if they ever were) to meet the demands of changing organizational environments. The theoretical work in this area has shifted away from the search for rules, and towards an analysis of managerial judgement in specific situational contexts' (Huczynski and Buchanan 1985:445). A popular example of the new approach is provided by Peters and Waterman's (1982) best seller, *In Search of Excellence*, which condemns the 'rationalist approach to management' because it fails to celebrate informality, gives little place to internal competition and denigrates the importance of values. Adhocracy is advocated as an alternative. One would expect Taylor to have turned in his grave. Drucker described it as a book for juveniles (quoted in Thompson and McHugh 1990:233) but it is one of the most influential management texts ever.

Human resource management and total quality management is also presented as constituting a break with the past. HRM displaces an industrial relations-personnel practice which revolved around procedures and agreements, rights and obligations, with an individual-centred employment relationship built on flexibility and commitment (Storey 1989). According to Graham James at the Work Research Unit, total quality management is about improving the quality of working life, '... a fear-free organisation in which employee involvement is vigorously pursued. It generates a high degree of reciprocal commitment, the individual to the goals of the organisation, and the organisation to the needs and development of the individual' (1991). For managers there was a price to pay. Organisational structures must be flattened and managers must give up power, pushing decision making downwards through the organisation. The 'de-layering' of middle management which this implied had been going on for some time. A million middle managers (one third of the total) lost their jobs in America in the ten years to 1988 (Harrington 1993: 264). But it seemed to promise new possibilities of meaningful work.

However, total quality management actually has two faces, the production oriented, statistical quality control systems, in which employee involvement is minimal, and the employee relations side which is linked to HRM and the drive to marginalise trade unions (Wilkinson et al 1992). Managers that survived de-layering found themselves more and more often faced with performance-related pay (Casey et al 1992). Nor can the ideological appeal of human resource management and employee involvement be taken at face value. In its heyday Taylorism made its own appeal to progress and freedom for the worker with promises of an end to the zero-sum game of pay bargaining (Maier 1970). All would benefit from the greatly increased production guaranteed by scientific



management. The pieceworker in particular would be freed from the dead level of mediocrity imposed on him by the trade unions and allowed to profit from his skills (*The Engineer* May 1905). Taylorism did not live up to such promises and the value-driven culture of excellence does not, in the end, get very far from the rationalist management it condemns. The central theme that makes excellent companies great, argued Peters and Waterman, is the ability to combine McGregor's theory x and theory y, Taylorism and human relations. This less than novel prescription is advanced with a dash of pre-Taylor paternalism. Top managers loved the worker, but were as hard as nails, 'Like good parents, they cared a lot - and expected a lot' (1982:96).

Trade union responses to the new management practices have been discussed by Lucio and Weston (1992) and Beaumont (1991). The latter notes that the TUC thought HRM individualised industrial relations and weakened membership commitment to the trade unions. The former identified three positions within the TUC; business unionism which looked for a social partnership with government and business; a collective bargaining approach labelled 'making Donovan work' (the GMB and UCW); and those, like the TGWU, who were holding on to independence. It is doubtful if such distinctions had much substance, though they may have described differences in political emphasis and style. The GMB/UCW's stillborn *New Agenda* (1991) was probably closest to the authentic voice of official trade unionism, offering to negotiate 'an employers led agenda socialised by the unions'. The endless adaptability of trade unionism is again made clear. But where Bedaux was anxious for trade union collaboration in the 1930s, employers showed no signs of interest in partnership in the 1980s (Beardwell 1992).

## **Technology, Business and Management**

If we leave aside for a moment what they should be called, the real question is whether the changes that are taking place amount to a significant moment of discontinuity. The brief sketch above of changes in the labour process and management and trade union thinking suggest that real change has been limited. But this may be misleading and needs to be put in context.

Hyman identifies the context of change to include, the end of the post-war boom, a realignment of international capital, the devolution within the corporation of operational policy making, a change in the composition of the workforce, a political shift to the right and deregulation, new computer technology and new production strategies (just-in-time etc.). The coming together of such a powerful constellation of forces is unlikely to mean a simple continuation of 'uninterrupted disturbance'. It is comparable in scale and significance to the changes at the end of the 19th century. All the elements are present, in new technologies, and changes in business organisation and management structures and practices, to suggest that the balance has shifted sharply from continuity to discontinuity. The difference is that by the beginning of the 20th century there was near unanimity, among advocates and critics alike, about the basic shape of the future. The late 20th century anticipates a post-Fordist, post-modern, post-industrial society, the precise character of which remains uncertain.

In these circumstances it is not always clear what survey evidence is measuring. Elger finds nothing that adds up to the claims of flexible specialisation but there are 'signs of significant innovations in the reorganisation and intensification of labour which go somewhat beyond established forms' (1990:78). Fairbrother says that 'A



major restructuring of work and employment relations is underway in manufacturing and the public services' (1988:3). But there has been no transformation. There have been moves towards 'Japanisation', an incremental creep towards flexibility, but nothing to justify claims that we have moved from one method of producing goods to another. On the other hand, all the changes in working practices which are identified, and do not yet amount to a new way of producing goods, are examples of practice claimed by flexible specialisation; decentralisation of company structures, an increase in part-time and shift work, computerised stock control and moves to just-in-time production, job mobility and contracting out and so on. Both surveys might be read as evidence confirming the direction of change as much as evidence of its limited progress.

The same might be said of Tomaney's survey of evidence from Japan, West Germany and the UK (1990). An IDS survey of major flexibility agreements is cited to show how limited change has been, but the core of the argument is less the question of how far change has gone than what it means. On one side new working practices are described as enlightened treatment of labour; reskilling and an end to division of labour; the re-emergence of the craft paradigm; flexible team working by skilled workforces. From the other side change means intensification of labour; increased monitoring and control of the individual; multitasking not multiskilling; and self subordination. Tomaney makes a convincing case for the second perception but because this is an extension of Taylorism, concludes 'there is no evidence that the tendencies of the past one hundred years are being reversed. Rather what we witness is the extension and redevelopment of existing forms of labour control and efficiency maximisation' (1990:53).

If Taylorism was only an extension of the process of transforming technology and the labour process familiar for more than a century (Brenner and Glick 1991), and flexibility only an extension of Taylorism, then truly, a great deal has changed in order that things may remain the same. We might nevertheless take a legitimate interest in the particular form that the capitalist labour process takes. And it does seem reasonable to conclude that strenuous efforts are being made to reconstitute the labour process in conditions of fundamental shifts in technology and business organisation even if these still fall a long way short of a transformation.

### **Beyond Taylorism**

The problem with 'transformations', in any case, is that they do not take place overnight. Indeed, they may drawn out over half a century. There is a parallel between the argument of Sabel et al that the American textile machine industry is held back by 'the rigidities of the vertically integrated, mass production system and the market organisation on whom it depended' (1987), and the institutional rigidities which Elbaum et al identify as the root cause of British economic decline. If such rigidities are read as the problem of adapting older structures in conditions of uneven development, the 'incremental creep' which Fairbrother identifies is more easily understandable.

If that incremental creep takes the labour process beyond Taylorism, that is unlikely to mean that Taylorism is dispensed with. We have already noted that management is not reducible to Taylorism but the legacy of Taylor seems likely to find a secure place in a reconstituted labour process. A labour process which places more emphasis on *mental skills* does not necessarily have to abandon Taylor. Indeed, Drucker has argued that 'The need is to do for knowledge work and the knowledge worker what Taylor, beginning almost a century ago, did for manual



work and the manual worker' (1976:27). Drucker's judgement may not be wholly reliable since in the same article he argues that Taylor would have regarded the assembly line as poor engineering and would have been a strong believer in 'theory'. Nevertheless, the assumption that information technology *requires* reskilling is demonstrably false. What is interesting in the present ferment is the attack on *management*, the spread of performance-related pay, 'de-layering', and the ideological attack on managers for wanting and misusing power. Managers may find themselves studied with as much interest as craftsmen once were.

But an attack on management does not necessarily mean new freedom for manual workers<sup>5</sup>. Taylorism has long since been absorbed by more sophisticated production engineering and planning in the office and is no longer needed in the crude form that it once took on the shop floor. As Waring puts it, 'Taylor's bureaucratic and corporate successors transcended his techniques but not his premises' (1991:203). The vision of a return to craft modes of production in computerised workshops linked by co-operative local agreements is a fiction of the imagination. In this sense the term neo-Taylorism or neo-Fordism would be more appropriate than *post-Fordism* (Palloix 1976). But this is a clumsy concept and continues to direct our attention to the past when we need to focus on the ways in which the labour process is being reconstituted.

If employers need to do for knowledge workers what Taylor did for manual work, ways are simultaneously being sought to secure from the manual worker the kind of commitment to the company that managerial and professional employees were expected to show. The effort might be packaged in a variety of ways as staffing policy, employee involvement, or customer care programmes within the company, and may involve new forms of work organisation like team working and quality

circles. But the ostensible aim is to win the hearts and minds of the workforce in ways that improve quality, productivity and competitiveness by creating a new work *culture*. If this appears in management programmes as empowering the employee, it can equally well be described in terms used by Thompson and McHugh, as 'Reinventing Organisation Man', reproducing conformity and loyalty to the company (1990:223). As such it would mark a more complete subordination of labour to capital, particularly if coupled with new work practices based on non-negotiated continuous improvement and increased individual monitoring and control.

Finally, we might note that, while trade union proposals to accommodate the new management techniques have been spurned, the offer itself suggests that change has gone far enough to make the status quo increasingly untenable. At the same time it is scarcely conceivable that problems relating to working conditions and work loads, productivity and employment, pay and the distribution of rewards, discipline and authority structures, all of which have been the cause of conflict, organised and unorganised, in the past, can now be resolved in a new individual-centred employment relationship, where a common commitment to the company directs the worker's attention to the customer and not her or his own interests as they see them. Indeed, if it is true that the labour process remains one which is based on exploitation and a tendency to reduce all labour to abstract, average labour, then the ideological promise of human resource management is likely to generate disappointment in the same measure as it raises expectations. The final shape of the labour process that will issue from the management of the new technologies at the end of the 20th century is far from settled.



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## Notes

<sup>1</sup> It is empiricism which lies at the root of the long standing British distrust of, and sometimes, hostility to, education. Caves is one of many to point to the distrust of skilled specialists and the disinclination to employ qualified scientists (1968 303); managers at Vickers in the 1930s who had a degree felt they had to hide the fact (Pagnamenta and Overy 1984:272); Paul Chambers of ICI thought postgraduate university life 'a bad training for the real world' (Clark 1966:9); and more than half the graduate engineers interviewed by Whalley did not consider their degree relevant to their jobs (1986:56).

<sup>2</sup> Alford notes that, 'In popular terms more responsibility for Britain's lack of international competitiveness has been laid at the door of trade unions than at that of management' (1988:68). But Melman comments, 'One of the striking aspects of our observations was the infrequency of reports from management as to worker opposition to production method changes' (1956:25). Theo Nichols (1986) addressed many of these questions in his *The British Worker Question*. There ought to be a British employer/management question. For the motor industry it would take account of the view of Williams et al that the failure of strategy in the motor industry 'was determined at the product planning and development stage where management was clearly and unequivocally in charge. If BLMC was killed by massive managerial miscalculation, it is unnecessary to blame the workers' (1983:253); or Edwardes on the lack of a breakdown of cost information by model (1983:52).

<sup>3</sup> The 'decay' of piecework schemes in the 1960s may have led some historians to read into the past their own understanding of the significance of shop floor struggles for workers control in a later period.

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<sup>4</sup> Takamiya records how, in the production of televisions by a Japanese multinational, 'Every movement of the operators is closely watched and constantly improved upon. Every mistake they make is constantly and individually fed back to them ...' (1981:9).

<sup>5</sup> Coriot believes there is a 'restructuration of the totality of movements which had first been fragmented' (1980:41), but the result is not a return to craft, 'the worker who is assigned to these new jobs cannot hope, in general, to acquire a socially recognised qualification'.



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I was unable to consult the records of the Bedaux company itself but I was fortunate to obtain from Ms Mildred Brownlow, the research director for the Bedaux company between the wars, a private collection of papers relating to the Bedaux company consisting of unpublished material including a number of draft histories of the firm. Where reference is made to these in the text, the relevant author is cited. A list of the main papers are detailed below.

Professor W. Brown kindly lent me the research reports written for the National Board for Prices and Incomes. I have only been able to make limited use of these reports given the focus of this research on the earlier period but they have been enormously helpful in outlining post-war developments in the uses to which work study was put. NBPI reports are referred to in the text simply by number (e.g., NBPI Report No3).

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